MEMOIRS

OF THE

WERNERIAN

NATURAL HISTORY SOCIETY.

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November 1811.

The Council of the Wernerian Natural History Society, *in order to meet the wishes of Authors of Communications, whose views and discoveries may be anticipated by delay in the publication of the Memoirs, have resolved that, in future, the Parts shall be published half-yearly, and that they shall be limited to the size and price of the present volume.*

May 1822.

MEMOIRS, &c.

I.—*On the Crystallisations of Copper-Pyrites.*

By W. Haidinger, Esq. of Freyberg, Member of the Wernerian Society, &c.

The regular forms of Pyramidal Copper-Pyrites, a mineral so well known as an ore of copper, and so generally spread over the earth, have, till of late, been described very imperfectly by mineralogical authors. The crystals of this mineral were taken for octahedrons and tetrahedrons, modified by the cube, the rhomboidal dodecahedron, &c.; and the cleavage exhibited in the massive varieties was supposed to take place in the direction of the faces of the octahedron.

A group of very distinct crystals, which I had the opportunity of examining in the year 1817, shewed, however, forms entirely incompatible with that of the regular octahedron, and with such as can be derived from it. These crystals had almost the shape of tetrahedrons, with truncated angles, as in fig. 1. (Pl. I.) The solid angle H was replaced by a face of cleavage, the intersections EF and FG of which, with the adjacent faces, were parallel to the lines AC and BD in these faces, the said lines being perpendicular to the edges IH and KL. If by planes parallel to

the smaller or triangular faces, A, I, H, &c. parts of this form are detached, until the remainder is contained under faces equal and similar to each other, the form will assume the appearance of an isosceles four-sided pyramid, as represented Fig. 2. The faces of cleavage are situated like those in the figure marked FEG, F′EG. In the hypothesis of the regular octahedron, four, or at least two, such faces should appear at each of the six solid angles; the result of which, in the first case, would be a *hexahedral trigonal-icositetrahedron*, in the second its *half*, the *pentagonal-dodecahedron.* This is, however, not confirmed by an accurate examination, since we find only four directions in which cleavage takes place, and this produces an *isosceles four-sided pyramid*, Fig. 3, the terminal edges AD, AD′ of which are parallel to the lines AD, AD′ in the figure 2, drawn perpendicularly from the apex A to the lateral edges of the given form. Supposing the axes of the two forms, of that of crystallisation, and that of cleavage equal, the horizontal projection or basis of the first CC′C″C‴ (Fig. 4.) will be a square *circumscribed* to the horizontal projection DD′D″D‴ of the second, and the sides of the bases CC′ : DD′ will be in the ratio of $\sqrt{2} : 1$. If, on the contrary, the bases are supposed equal, the axes of the same two forms will be in the ratio of $\frac{1}{\sqrt{2}} : 1$. Let the more obtuse pyramid be designated by P, the more acute one will be represented by P+1.*

These forms belong to the *Pyramidal System* of Mohs, and the crystallisation of Copper-pyrites can therefore, by no methodical means of proceeding, be derived from the

* For the derivation of these pyramids, their belonging to a series of pyramids, and for the designation of its members, compare the *Supplement* to *Encyclopædia Britannica*, article Mineralogy.

regular octahedron, or any other form of the Tessular System.

By considerations of this kind, it became very probable that the angles of the four-sided pyramid of copper-pyrites would, by an accurate investigation, prove different from those of the regular octahedron. Such a difference has indeed been found by an immediate measurement with Dr Wollaston's reflecting goniometer, which yielded the angle at the basis of the four-sided pyramid = 108° 40′; due attention being given to all the necessary corrections required in the use of that instrument. The difference between this angle of 108° 40′, and that of the regular octahedron = 109° 28′ 16″, amounts only to 0° 48′, a quantity very easily missed in employing the common goniometer *, for the determination of the angles. Moreover the crystals are commonly very small, which adds to the difficulty of having correct results from the application of this instrument. The little difference existing between the angles of the pyramid of copper-pyrites and those of the regular octahedron, the smallness, and after all the scarcity of distinct crystals, so as to have all their homologous faces of equal extent, sufficiently account for the incorrect ideas hitherto current among mineralogists respecting the system of crystallisation of the present species.

* The Abbé Haüy allows errors to be possible in measurements of this kind to the amount of a whole degree. He says, (*Traité*, t. ii. p. 325). "On voit que les différences entre les angles donnés par les deux hypothèses ne vont pas audelà d'un degré (being 0° 0′, 1° 14′, 0° 9′, 1° 0′), et que celle qui appartient à la troisième, n'est que de 9′. Or, quoique ces différences résultent de mesures prises avec beaucoup de soin sur des cristaux d'une forme très-nette, il est possible, après tout, qu'une erreur due à l'observation en produise de semblables."

The immediate measurement was nevertheless not required for proving these forms to be pyramidal. This is evident by their mere inspection, observing only how their edges of combination are situated; and it might have been found that the angles of the pyramid differed from 109° 28′ 16″ even less than could be determined by any measurement; without making the form by this only to cease to be what it was, an isosceles four-sided pyramid, and to change it into the regular octahedron. Naturalists thought themselves, however, still more confirmed in the last opinion by a sort of twin-crystals, very common in copper-pyrites, which bear a strong resemblance to those of octahedral and dodecahedral corundum, and of octahedral iron-ore, and, therefore, had been supposed to take their rise from the same forms, as in these species.

It will not be without interest to compare the chief mineralogical authors on the present subject, before we turn to the observation of Nature.

The first author that treats more at large of copper-pyrites, is HENCKEL, who wrote at a period when the future importance of crystallographical knowledge for mineralogy scarce was thought of. He gives in the Pyritologia (Leipzig, 1725, p. 157.) the description of those tetrahedral varieties whose forms have since been taken for the regular tetrahedron. The twelfth plate, however, "*Pyrites decaëdros*," excepting only Fig. 2., represents a variety of copper-pyrites not uncommon in nature, and which we shall return to afterwards. From these drawings, founded upon correct observations, it might have been argued, that some one pyrites or other had a pyramidal form, though it could not be determined to which of them these observations referred.

ROMÉ DE L'ISLE, and, after him, HAÜY, consider the crystalline forms of this mineral as deriveable from the

regular octahedron, or, more properly, from the tetrahedron. The latter even alleges cleavage to take place parallel to the faces of the tetrahedron, and gives the *Caractère geometrique* of *Cuivre pyriteux* thus:

> "Forme primitive. Le tétraèdre régulier, (fig. 78. pl. lxx.) Quelques cristaux offrent des indices de lames parallèles aux faces de ce solide."—*Traité*, t. iii. p. 530.

The forms he describes as modifications of the regular tetrahedron, and others in connection with it, moreover under the denomination of *Cuivre pyriteux transposé*, the twin-crystal mentioned above, which he compares with those of spinel.

Romé de l'Isle, in order to give a distinctive character between the hexahedral iron and the pyramidal copper-pyrites, states the crystals of the latter always to possess the form of tetrahedrons, more or less modified. *Crystallographie*, t. iii. p. 310.

But, says Haüy, sometimes copper-pyrites is observed in the form of the octahedron, perfectly regular; and since this form is equally found in iron-pyrites, the line of demarcation disappears. *Traité*, t. iii. p. 534.

The mineralogical works, according to the Wernerian method, infer uniformly copper-pyrites to have tessular forms, describing them as tetrahedrons, octahedrons, &c.

From a comparison of all the preceding, and of many other mineralogical books, it appears that none but Henckel's could excite even a suspicion that the form of the present species is pyramidal; and thus our endeavours towards the advancement of truth, in this particular, as well as in Natural History in general, will be the less subject to errors, the more strictly we follow the advice of that intelligent natural philosopher, in deriving our knowledge of the natural productions from the observations of those objects themselves.

The regular form most commonly exhibited by the crystals of copper-pyrites, is that represented in Fig. 5. The re-entering angles shew that it belongs to a compound, and not to a simple mineral. It is the same twin-crystal, which, from its great resemblance, has been confounded with those of the octahedron in Spinel and other minerals. The forms of the individuals can be obtained from the variety Fig. 5., by laying a plane through the re-entering angles, and turning one of the parts thus detached in this plane under an angle of 180°. The result of the operation is the form Fig. 6.

This form is not contained under planes altogether equal and similar to each other, and therefore is not a simple one. It is a combination of four different simple forms, to one of which belong the octagonal, to another the oblong rectangular, to a third the irregular hexagonal, and to a fourth the trapezoidal faces. Each of these forms is produced in succession, by enlarging the homologous faces, till the rest disappear. Thus the irregular hexagonal faces yield that four-sided pyramid, which by measurement is found to have the angle at its basis = 108° 40′, and for the present species bears the designation P. The trapezoidal faces are parallel to the faces of cleavage; their intersections with the faces of P are parallel to each other, and to the terminal edges of that pyramid, which results from the enlargement of the trapezoidal faces themselves; the axis of the pyramid therefore, as we have seen above, is equal to the axis of P multiplied by $\sqrt{2}$; and the pyramid itself, P+1. The rectangular faces likewise produce a four-sided pyramid, which, since it appears with parallel edges of combination in the place of the terminal edges of P, is to this pyramid in the same ratio, in which P is to P+1. Its axis will therefore be equal to the axis of P divided by $\sqrt{2}$, and itself the member P−1 of the same series, to which

belong P and P+1. Lastly, the octagonal faces are evidently perpendicular to the axis of the combination, or to the common axis of the three pyramids, and give therefore a four-sided pyramid of an infinitely short axis, the limit of the series of isosceles four-sided pyramids, P — ∞.

The combination contains the faces of

$$P-\infty \,.\, P-1 \,.\, P \,.\, P+1.$$

The angle at the basis of P, and the relations of all the other pyramids to it being known, it will not be difficult to find the dimensions of all these forms. By immediate measurement the angle at the basis of P has been found $= 108° \, 40'$. From this follows by the formula,

$$a = \frac{1 - \cos. z}{1 + \cos. z}$$

the axis $2a$ of P $= \sqrt{7.7648}$. The axes of the members of the series being in the ratio of $1 : \sqrt{2} : 2$, &c., that of P—1 will be $= \sqrt{3.8824}$, that of P+1 $= \sqrt{15.5296}$.

If $2a$ signifies the axis of any isosceles four-sided pyramid, x the angle at one of its terminal, z the angle at one of its lateral edges, we have the formulæ,

$$\cos x = -\frac{1}{1+a^2}, \text{ and } \cos z = \frac{1-a^2}{1+a^2}.$$

The following table contains the angles of the three pyramids, calculated according to these formulæ, $2a$ of P being supposed equal to $\sqrt{7.7648}$.

PYRAMIDS.	x	z
P—1	120° 30′	89° 9′
P *	109° 53′	108° 40′
P+1	101° 49′	126° 11′

* As it is given in M. Mohs' characteristic.

Some of the most remarkable varieties of forms hitherto observed in copper-pyrites are the following:

1. P. fig. 2. The pyramid of 109° 53′, 108° 40′, without any additional face. Commonly the alternating faces of this form are larger than the rest, a peculiarity of certain series of crystallisation, which, for the present system, has been called *Hemipyramidal* in Mr Mohs' characteristic. The form thus produced is that of fig. 1.; and it even sometimes happens, that the smaller faces disappear entirely, so as to give something like a tetrahedron, which, however, in reality is only *half* of an isosceles four-sided pyramid. Forms of this kind are very frequent in copper-pyrites, though in some cases they appear more striking than in others.

2. P. P+1. fig. 7. Sometimes the faces of the latter of these pyramids are much more extended than those of P. Very distinct specimens of this variety have been found in the mine Alte Elisabeth, near Freiberg, in Saxony.

3. P—8. P. fig. 8. The same variety to which Henckel's drawings of "*Pyrites decaëdros*" refer.

4. P—1. P. P+1. fig. 9.

5. P—2. P+1. $\frac{3}{2\sqrt{2}}$P+1. fig. 10. The first of these pyramids is in the same ratio to P—1, in which P—1 is to P. Its axis will therefore be

$$2a = \sqrt{1.9412};$$
$$\text{terminal edge} = 132°\ 19';$$
$$\text{lateral edge} = 69°\ 44'.$$

The second is identical with the more acute of the second variety. The last is not a member of the principal series; in the seventh variety, its relations to the members of that series will be developed. The axis of this pyramid is

$$2a = \sqrt{17.4708};$$
$$\text{terminal edge} = 100^\circ\ 44';$$
$$\text{lateral edge} = 128^\circ\ 51'.$$

Locality: the mines of Nassau-Siegen.

6. P—∞. P. P+1. fig. 11.

7. P—2. P. $\frac{3}{2\sqrt{2}}$P. $\frac{3}{2\sqrt{2}}$P+1. fig. 12. The first, second, and fourth, of these pyramids, are already contained in some of the foregoing combinations. Their position to each other is the parallel one. We shall make use of fig. 13. for the developement of the relations in which the third and the fourth of these pyramids are to the members of the principal series.

The intersection of the face *b* (fig. 12.) of P—2, and the face *a* on one side, is parallel to that of the same face *b*, and the face *c'*, opposite to *c*, on the other. In fig. 13., both the faces *a* (LQKHF) and *b* (GKH) pass through the point H, and their intersections with *c'* (NAE) coincide therefore in the line HK.

OI is half the axis of the more obtuse pyramid, one of whose faces is *b*, if AO is half the axis of the more acute pyramid one of whose faces is *c'*; because, in this case, GH is the side of their common horizontal projection.

Now GO : OI = GP : PK, and from the similarity of the triangles KPO and AOR,

$$OA : PK = OR : OP.$$

From the triangles OKP and RKP being equal and similar, it follows that OP = PR, and OP = $\frac{1}{2}$ OR, therefore PK = $\frac{1}{2}$ OA.

Thus, the first proportion becomes

$$GO : OI = \tfrac{3}{2}\ GO : \tfrac{1}{2}\ OA,$$

and, $OA : OI = 3 : 1.$

The horizontal projections being equal, the axis of the more acute pyramid is three times as long as the axis of the more obtuse; from which follow the angles as they have been stated in variety 5.

The pyramid which appears with parallel edges of combination on the terminal edges of $\frac{3}{2\sqrt{2}}P+1$, is evidently $\frac{3}{2\sqrt{2}}P$, being the subsequent more obtuse member of the same subordinate series to which the other pyramid belongs.

Its axis is $= \sqrt{8.7354}$;
terminal edge $= 108° \; 18'$;
lateral edge $= 111° \; 50'$.

8. $P-\infty$. $P-1$. P. $P+1$. fig. 6. The same variety, which in the preceding we have made use of for the development of the three pyramids of the principal series. It is one of the most common varieties of copper-pyrites, and occurs more or less distinct in a great many localities.

9. P−∞. P. $\frac{3}{2\sqrt{2}}$P. P+1. fig. 14. It would have been impossible to derive from this combination, without other forms entering into it, the relation of $\frac{3}{2\sqrt{2}}$P to P; the pyramids of the subordinate occurring at the same time with P−2 of the principal series in variety 7. afforded the data required for this development.

10. P−2. $\frac{3}{2\sqrt{2}}$P. P+1. $\frac{3}{2\sqrt{2}}$P+1. P+∞. fig. 15. (Pl. II.)

11. P−2. $\frac{3}{2\sqrt{2}}$P. P+1. $\frac{3}{2\sqrt{3}}$P+1. P+2. fig. 16. The most acute of these pyramids is the member subsequent to that which appears with parallel edges of combination in the place of its terminal edges. The last member, from several varieties already mentioned, is known to be P+1; and thus the new pyramid can be nothing else than P+2.

Its axis is $= \sqrt{31.0592}$;
terminal edge $= 96° 32'$;
lateral edge $= 140° 31'$.

12. P−∞. P−2. $\frac{3}{2\sqrt{2}}$P. P+1. $\frac{3}{2\sqrt{2}}$P+1. fig. 17.

13. P−∞. P−2. P. $\frac{3}{2\sqrt{2}}$P. $\frac{3}{2\sqrt{2}}$P+1. fig. 18.

14. $\frac{(P-n)^m}{2}$. P−1. P. P+1. fig. 19. This combination presents very distinctly the remarkable singu-

larity of the series of crystallisation of copper-pyrites, the alternating faces of P, and of other forms, to be much more extended than the rest of the faces of the same, which even sometimes entirely disappear. This last is indeed the case with the forms to which belong the small triangular faces a, a', situated between the faces of $P-\infty$, $P-1$, and the enlarged of P. If all the faces of this form would appear, the result would be a scalene eight-sided pyramid, fig. 20; but instead of sixteen, we find only eight faces, and if we enlarge these, till they limit the space by themselves, the resultant form is contained under eight equal and similar scalene triangles, as represented fig. 21, which nevertheless is not a scalene four-sided pyramid, but must be considered as *half* of the eight-sided. This form is produced at once from the scalene eight-sided pyramid by enlarging the alternating *pairs* of the faces till the rest disappear. The dimensions could not be determined, on account of the want of parallel edges of combination between the half of the eight-sided pyramid, and other forms; besides the smallness of the crystals would not allow any application of a goniometer.

15. $P-\infty$. $P-1$. P. $P+1$. $(P+\infty)^3$. fig. 22. The present variety differs from that of fig. 6. only by its having eight rhombic faces disposed vertically round the axis.

Suppose fig. 23. to be the projection of fig. 22. upon a horizontal plane*.

If the faces a, a', &c. are rhombs, OP' must be $= P'Q = QP'' = P''O$, and $OP = PQ$.

* The letters signify the same in both the figures.

Now OP : PQ = NA : AQ, or, what follows from it, NA = AQ.

But since the angle OAQ is = 135°,

$$ON = NA,$$

$$\text{and } NQ : NO = 2 : 1,$$

which gives the angle OQN = 26° 33′ 54″, and ORO′ = 126° 52′ 12″, equal to the angle of the transverse section of $(P+n)^3$. *

16. $P-2.\ \frac{3}{2\sqrt{2}}P.\ \frac{3}{2\sqrt{2}}P+1.\ P+\infty.\ [P+\infty].$ fig. 24.

Crystals of this form are very easily taken for tessular, particularly if they are fixed to some support, so as to allow only a few of their faces to be observed.

17. $P-\infty.\ P-2.\ P.\ \frac{3}{2\sqrt{2}}P.\ \frac{3}{2\sqrt{2}}P+1.\ P+\infty.$ fig. 25.

18. $-\frac{P-2}{2}.\ \frac{(P-n)^m}{2}.\ P-1.\ P.\ P+1.\ P+\infty.\ (P+\infty)^3.$

fig. 26. There occur in the present combination only the alternating faces of the pyramid P—2. By their enlargement we arrive at a solid contained under four isosceles triangles, fig. 27., analogous to the tetrahedron, and to that in var. 1., which is produced by the increasing of the alternating faces of P. The form is in the designation marked with —, to denote its faces to be alternating with the enlarged faces of P.

* Encyclopædia Britannica, article Mineralogy.

The last of these varieties is hemipyramidal, not only by the two forms P—2 and $(P-n)^m$ entering into it with half the number of their faces, but also by the difference in the extension of the alternating faces of P. There is, however, besides this difference in the extension, still another existing between those faces, which can be of use, if attended to, in examining crystals very much engaged and grouped with each other. The enlarged faces of P always bear distinct *striæ*, parallel to the edges of combination of this form with P+1. Striæ in the same direction occur also upon the smaller faces of P, but they are generally very indistinct, and even, in some cases, not at all observable. The faces of the other forms are commonly smooth, and not streaked at all, only P—1 and $\frac{3}{2\sqrt{2}}P$ have sometimes a few horizontal striæ.

The variety in the forms of Copper-pyrites, and at the same time the difficulty of recognising them, is greatly increased by the scarcity of *Single Individuals* affecting the above mentioned forms. More commonly we find two or more individuals regularly grouped with each other; so that, besides compound forms, we have to consider compound minerals, in which, however, the composition takes place under certain crystallographic laws.

The regular aggregations or compositions of two individuals have received the names of *Twin*, or *Hemitrope* crystals, according to their being considered as produced by two simple crystals; or by a single one cut in two parts, in which the one half has undergone a revolution of 180° in the same cutting plane. In general, regular aggregations or compositions may be conceived to arise from several individuals, each two of which are in contact with each other in a face parallel to a face, or perpendicular to an edge of crystal-

lisation, of any simple form belonging to the species; after having previously received such a position, that one of them is removed 180° from the parallel position with the other, in a plane, which is always parallel to a face of crystallisation of that species to which the individuals belong.

The *Face of Composition*, as well as the *Plane of Revolution*, may assume a great many different positions, only they must always be similarly situated in respect to both the individuals that are joined together.

The varieties of regular aggregation, or composition, hitherto observed in Copper-pyrites are the following:

I. The plane of revolution parallel to a face of P.

1. The face of composition parallel to the same face of P. Form of crystallisation: P, fig. 28.
2. The face of composition perpendicular to a terminal edge of P+1. Supposed form of crystallisation: P+1, fig. 29.

II. The plane of revolution parallel to a face of P—1.

1. The face of composition perpendicular to a terminal edge of P. Supposed form of crystallisation: P, fig. 30. (Pl. III.)

III. The plane of revolution parallel to a face of [P+∞].

1. The face of composition parallel to the same face. The result of this law in the form P, whose alternating faces are enlarged hemi-pyramidally, would be fig. 31. This, however, does not occur; the component individuals do not end in their face of contact, but parts of them appear also on the other side of this face,

and thus bodies are produced like that represented fig. 32.

The law expressed in I. 1. is the same that occurs in the variety, fig. 5, considered above; it is met with in many instances in those represented fig. 2, 7, 8, 9, 11, 14, 19, 22, 26. This sort of aggregation is very often repeated in faces parallel to themselves, from which, if it is in crystals, forms result like fig. 33. It extends, however, also to massive varieties, which then consist of alternating laminæ of this mineral to be distinguished from each other by the different direction of the faces of cleavage. It is evident that the alternating laminæ must be in parallel position with each other, on account of two revolutions of 180° being required in the same plane to determine the position of the third lamina in respect to the first.

The law I. 2. is not so generally found as the foregoing; it gives rise to forms as fig. 34, where the individuals are of the variety fig. 6. The faces a and a'; a'' and a''' of the pyramid P+1 fall into the same plane; so do the faces b, b' of the pyramid P. This is a necessary consequence of the face of composition being perpendicular to the terminal edge of the pyramid P+1; which edge is parallel to a line drawn on the face of P from the apex, perpendicularly to one of the lateral edges of this pyramid.

Some varieties, as that of fig. 12, are subject to the law II. 1., and then produce regular aggregations, as figg. 35, 36, in the latter of which, as is sometimes the case, the faces of $\frac{3}{2\sqrt{2}}$P, between the apices of the two individuals are wanting. The compound consists very often, by a repetition of this law, like that occurring in I. 1, of alternating laminæ, parallel, now to one, now to the other individual. The variety of regular aggregation, or composition,

we have just described, and which takes place perpendicularly to one only of the terminal edges of P, is rare, and the very few instances I know of, are to be found among the varieties from Nassau-Siegen. But it is also met with, at the same time, upon all the terminal edges of P, and then it is one of the most common regular aggregations in the present species. The faces *a a′ a″*, *b b′ b″*, fig. 37, of the different crystals, fall into one and the same plane; which, of course, cannot be the case with the faces *c c′ c″*, *d d′ d″*, on account of the difference of the pyramid P from the regular octahedron. Crystals thus produced have been taken for simple, and described accordingly as octahedrons truncated on all their edges and angles. The appearance, indeed, is very seducing, if we do not attend to the striæ, which, in the different individuals, follow different directions, parallel to lines drawn from the point E to the respective apices of the pyramid P in the three individuals, whose faces meet in this point. The remaining parts of the faces of P+1 make sometimes re-entering angles, as in fig. 38, which adds to the evidence of such forms being compound.

The tetrahedral crystals from Cornwall are subject to the same law, only the individuals appear more decidedly hemi-pyramidal, so as to present only half the number of the faces of P. Generally they assume the form fig. 39, where the faces of $\frac{P}{2}$ are deeply streaked by the accession of the faces of P+1; though the mathematical regularity would require it to be so as represented fig. 40, where the lines AE, A′E; AC, A′C, &c. denote the junction of the different individuals. The striæ of the crystals are so deep and so numerous, that, instead of the faces AEA′, A′EA″, A″EA falling into one plane, the lines of junction AE, A′E, A″E are marked by re-entering angles.

The individuals do not invariably join in the aggregation according to only one of the laws expressed before; sometimes more than one exercise their influence at the same time. Thus the variety, fig. 41, is a compound of two parts, according to the law I. 1.; and each of those parts, again, according to the law II. 1., acting simultaneously on all the terminal edges of P. There are, in the same manner, crystals to be found, in which I. 2. and II. 1., others, in which II. 1. and III. 1., take place at the same time. In such cases, the resultant crystallisations commonly lose more or less of their regularity from the different relative size of the individuals entering into the composition; and it would, indeed, be sometimes difficult to point out the law it follows, had Nature not, since the streaking of the faces in every case is an effect of combination, and directed parallel to its edges, thus provided us with a means, which will always lead us the right way, and which, if duly attended to, is also of great moment for similar considerations in other species.

II.—*Notice of the Attempts to reach the Sea by Mackenzie's River, since the Expedition of Sir* ALEXANDER MACKENZIE.

(*Read 17th November* 1821.)

THE North-West Company first established a fur-post on the banks of Mackenzie's River in the year 1795, and have ever since maintained a greater or smaller number of establishments on various parts of its course. At present, the lowest or most northerly post is Fort Good-Hope, situate about 100 or 120 miles below the influx of Great Bear-Island Lake River, and, as is supposed, about three days' voyage in a light canoe from the sea, which, with the current of such a river, is usually estimated at from 50 to 80 miles *per* day. From the summit of a small hill behind the Fort, the upper limb of the sun is just visible at midnight, on the 21st of June.

In the immediate vicinity of Fort Good-Hope, and on the east side of the river, the Hare Indians reside; and their lands, to the northward of the very extensive piece of water which is named Great Bear-Island Lake, and which is said to be inferior in size to Lake Superior alone, borders upon the Eskimaux grounds, which skirt the sea-coast. The Fort is also visited by the Loucheux, or Squint-eyes, who inhabit the west bank of the river, and who are separated from the Eskimaux by the Vermilion River, about 2½ days' voyage below Fort Good-Hope. At this boundary, they often trade with the Eskimaux, and obtain, at a high price, certain smooth sea-shells, to be inserted as ornaments into the septum of the nose. They have also obtained at these friendly meetings, strips of whalebone, and

pieces of the skin and other spoils of sea animals. Notwithstanding this occasional friendly intercourse, however, these two tribes more often enter each other's territories in a hostile manner; and so many of the Eskimaux have been cut off, that that nation is justly very jealous of the visits of strangers.

Two attempts have been made to reach the sea since the period of Sir ALEXANDER MACKENZIE's voyage. The first, by Mr LIVINGSTON, in the year 1799; when that gentleman, accompanied by JAMES SUTHERLAND, an interpreter, three Canadians, and three Indians, descended in a bark-canoe, a little below the Vermilion River above mentioned. Here they met with a single Eskimaux in his small seal-skin boat, whose first act, notwithstanding the disparity of force, was to discharge an arrow, which penetrated through the sides of the large canoe. They approached him, however; and adopting the mode in use among the Indian nations of discovering the intentions of strangers, presented him with a portion of meat, having first chewed a bit of it themselves. He threw it away with disdain, and refused to receive any of their presents; but directed them to put ashore, and made signs that his countrymen were at no great distance. They complied with his request, whilst he proceeded down the stream; and in a short time returned, accompanied with five of his companions, each in his small canoe, and armed with a bow and arrows. Mr LIVINGSTON endeavoured to conciliate them by presents of beads, and other articles; but instead of appearing pleased and grateful, they tied the strings to a pole, and cut them in pieces with their arrows. The Indians now warned Mr LIVINGSTON, that he would in vain attempt to establish a friendly communication with such people in their present state of mind, and were urgent for immediate embarkation, when it was discovered that the paddles of the canoe had

been conveyed away by stealth. Such an unequivocal demonstration of a hostile purpose, increased the apprehensions of the party, and they hurried into the canoe, but were instantly assailed by a flight of arrows from the Eskimaux, each of whom shot three from his bow at a time. Mr LIVINGSTON and a Canadian voyageur fell under the first discharge: two of the Indians, who had not yet embarked, but were holding on the bow of the canoe, let go, and escaped into the woods, whilst JAMES SUTHERLAND and the other survivors floated down the stream. They were instantly pursued by the Eskimaux in their boats, and the Indians from their hiding places observed the conflict to be carried on until five of the Eskimaux were killed, and JAMES SUTHERLAND was left alone in the bow of his canoe, which was in a sinking condition. This much was learnt from one of the Indians, who travelled to Fort Chepewyan with the account of the melancholy catastrophe, having, in his route, had his wants supplied by parties of the Loucheux, and other nations he fell in with. It was afterwards ascertained, through the medium of the Hare Indians, that the canoe had drifted down opposite the main encampment of the Eskimaux, and that JAMES SUTHERLAND there threw himself into the water, swam ashore, and placed himself betwixt the knees of an elderly man, for protection. A consultation being now held, his destruction was decided upon; and as he was judged invulnerable from his having escaped from the conflict without a wound, they effected their purpose by tying a stone round his neck, and throwing him into the river; his protector having in the mean time conveyed himself away, it being contrary to their ideas of humanity that he should witness the death of his protegé.

The year following this tragical event, a party of the Red-knife or Copper Indians, making war upon the Eskimaux, at the mouth of the Copper-mine River, found some

part of the clothing of Mr LIVINGSTON's party in the huts of those they destroyed.

A second attempt to reach the sea was made by Mr CLARKE in 1809. He descended the river as far as the assemblage of islands which form the various channels of which Sir ALEXANDER MACKENZIE speaks; but here a numerous party of Eskimaux, occupying both banks of the river, put themselves in such a menacing attitude, that it was deemed prudent to return, without making any attempt either to land or to proceed farther.

In 1810, a large shoal of porpoises came up to Fort Good-Hope, to the great grief of the natives, who declared that such visits were always attended by a falling off in the fishery, which accordingly proved very bad that season. This fact, we think, tends to prove the near vicinity of the sea, and that Sir ALEXANDER MACKENZIE either actually saw it, or was within a very short distance of it.

The country through which Mackenzie's River flows, appears to offer a fine field for a naturalist, and we have had many interesting accounts of it from those who have resided there. It is well worthy the attention of a mineralogist, who would have an opportunity of viewing the operations of Nature on a grand scale. The rocky mountains range along the western side of the river, at a greater or smaller distance from its banks; in some places receding to the distance of 70 miles, at others approaching the very verge of the stream, and at one spot below the Great Bear Lake River, a continuance of the same ridge appears on the eastern side of the river.

A kind of sheep frequents those mountains, which, from description, appears to resemble, or to be the same with, the *Argali*, or *Ovis montana*. It has very large, striated, spiral horns, and is clothed in the winter with a thick coarse coat of hair, like that of the rein-deer, which falls *off* in the

summer, and is succeeded by a shorter and finer covering *. There is another animal of still greater interest, which the traders call the Goat, and which would appear to be a species of antelope. Its horns, smooth, short, and black, are directed backwards, with a slight curvature. It is about the size of a sheep, and, in the winter, has a coat of long curled hair, said to be of a silky fineness and lustre. It springs with great agility from precipice to precipice, and possessing, like the sheep, a very quick eye, its capture is attended with much difficulty. I have heard that the skins of these animals have been sent to Europe; but neither of them have hitherto been taken alive †. A very large kind of rein-deer is also found on those mountains.

The natives make knives of a white translucent stone, which they detach in large sharp-edged flakes, by greasing a portion of the rock, and kindling a fire upon it.

They also dig up an edible unctuous earth, similar, probably, to that which is found at the mouth of the Orinooko; and use as a pigment a mineral substance, which they find at the bottom of a small subterraneous stream. It is in the form of round, flattish, ponderous grains, of a shining black colour, with a greasy feel, and adheres to the skin only when mixed with grease. A large specimen of native silver was also found in that neighbourhood in 1796.

Near the Great Bear Lake River, there are some coal-mines on fire. And there are several fountains of mineral-pitch, one in particular, which rises in the channel of the river, at a spot, which, from that circumstance, is named the Flaming Point.

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* Specimens of the head of this animal were sent from Hudson's Bay by William Auld, Esq. to Professor Jameson, and proved to be the true Argali.—Edit.

† The animal described in the text appears to be the Rocky-mountain Sheep of the Americans, noticed by Professor Jameson in the third volume of the Wernerian Memoirs, p. 306.—Edit.

III.—*Geological Notices, and Miscellaneous Remarks, relative to the District between the Jumna and Nerbuddah;*

WITH AN APPENDIX,

Containing an Account of the Rocks found in the Baitool Valley in Berar, and on the Hills of the Gundwana Range; together with Remarks made on a March from Hussingabad to Saugar, and from thence to the Ganges.

By Dr ADAM of Calcutta, Member of the Wernerian Society.

(*Read 12th January* 1822, &c.)

THE specimens of minerals sent to Professor JAMESON, comprise all the rocks met with between the Jumna and the Nerbuddah, by the route of Banda, Lohargong, Bellary, and Jubbulpore.

The first commences with the hills in Bundlecund, after crossing the Jumna. Between these hills and the river is situate a plain of considerable extent, the soil of which differs so greatly from that of the opposite country in the Doab, as to merit particular notice. It may be observed, generally, that the soil of the plains of Hindostan, from

Cawnpore to Calcutta, and indeed from Hurdwar *intra Gangem*, is a light-coloured mould, consisting of a due proportion of argillaceous, siliceous, and calcareous earths. the last being most abundant above Marghyr. Its chief characteristic is derived from the quantity of mica which it contains, in minute grains and scales. This also prevails in the district which I passed through, from Allahabad to Chillyterrah Ghaut, on the Jumna. About half a mile to the north of this river, we descend a bank, which appears to form its boundary in the rainy season, and enter upon a low flat, where, in place of a fair, shining, attenuated mould, the eye meets nothing but an uniformly dull, coarse, black earth, not unlike the half-digested soils of muirlands at home. This dark soil is still more striking on the Bundlecund side, and continues almost the whole way to Besseramgunge. It seems to contain a larger proportion of argillaceous earth, and vegetable recrement, than the land on the left bank of the Jumna, and that which is generally observed in the upper provinces of India.

The Jumna, where the passage is made, is a smooth gently-flowing stream. The banks show no rock, but are high and perpendicular; and, when viewed from the opposite side, along with the advancing stream, the Cane, which here joins its waters to the Jumna, look uncommonly well, and are devoid of the dulness which characterises the whole course of the united rivers the Ganges and Jumna, below Allahabad.

On approaching the town of Banda, distant two marches, or about twenty miles from the river, several small hills are seen in the west, like erections for flagstaffs, posted at regular intervals. They appear to run in one line, from NW. to SE., and are of a conical, or rather pyramidal, figure. One of them rises from the plain close to Banda; it is about three or four hundred feet high, and is divided, at the up-

per part, into two or more smaller elevations, of which the central only terminates with a pointed summit. The appearance of the hill, from below, is singular and fantastic; huge masses of stone presenting themselves in every position, seemingly quite unconnected the one with the other, while a few shrubs, growing out from between them, serve as a contrast to the nakedness of the rock. On ascending the hill, we found it to be composed of a reddish-coloured small-grained granite, having no regular arrangement, but lying in blocks of great size, some perpendicular, and others horizontal, with a convex or rounded surface in general. Many of these are scaling off at the surface; but the greater part remain entire, and possess more compactness of integrant structure than any rocks of the kind which I have met with. This hill at Banda may be reckoned the termination of the first of the many series which traverse Bundlecund from W. to E., as no more are observed here following that line.

Soon after leaving Banda to the south, other hills come into view, which, at first sight, appear larger than the one at that place. This is chiefly owing to the effect of distance, increased by the dewy air of the morning, which is the time of travelling; for, on a near approach, we find these not to exceed the congeries at Banda, or the highest does so only in a small degree.

Though evidently entering upon a mountainous country here, we are surprised to find no general elevation of the surface, the same flatness of the plains continuing as on the northern side of the Jumna, and the hills rising abruptly from a common level, like so many islands rearing themselves out of the ocean. They are, in fact, mere pictures, on dry land, of the rocky Madeira, Porto Santo, or the Canaries, seen in the voyage from England to India.

About twelve miles from Banda, at the village of Ge-

raiah, or Gerawah, we came to this second series. The general figure of these hills, like the former mentioned, is pyramidal; and they may be said, in this respect, to resemble a fragment of the granite rock which composes them. They stretch from the village of Geraiah in two or three directions, the line of some crossing that of others, and, notwithstanding their irregularity as a range, they appear to follow individually particular series; and we can trace a succession of isolated rocky elevations forming chains across the country. The largest of these, which is situate to the right of the village, has at the summit a rock of a white colour, like chalk, which I regretted, from the distance it was placed at, I could not examine. The others are composed of granite, similar to the rock at Banda, and present the same arrangement, or more properly, deficiency of arrangement, seen at Banda. At the lower part of one of those hills, quartz veins, distinct from the general composition of the granite, intersect it to a considerable extent; and on the summit, the blocks have assumed the shape of basaltic columns, standing perpendicularly, with four sides, which, at some distance, makes them appear like an overlying stratum of a different formation.

The country in this neighbourhood displays a thousand charms, compared with the district near the Jumna. The roads are dry; and the rocky elevations in front, having a covering of beautiful shrubs entwined with numerous varieties of climbing plants, give quite a new feeling to the mind on viewing the prospect. New animals, too, inhabitants of these, present themselves. The peacock, arrayed in all his gorgeous hues, and shining with a native glossiness of plumage, is not unfrequently seen perched on a projecting block of granite; while herds of antelopes bound along the plain below; and the shrill cry of the Indian partridge

heard on every hand, first cheers the traveller with the opening day. I was much delighted one morning here, with viewing the natural phenomenon of sun-rise. Contrary to my usual practice, I had started early with my baggage. It was quite dark, excepting what light the stars afforded, which, in India, is always considerable at this season (October), when not a cloud obscures the expanded vault of the heavens. After moving on for some time, on turning my eye toward the east, I could perceive the first appearance of day. It was not dawn, but a mere greyish pillar of light shooting from the horizon upwards, in the shape of a comet's tail, but without lustre; the effulgence, if it could be so called, resembling that of the Milky-way more than any other object in nature which I have seen. This dull pillar of light was well defined. It continued a long time apparently little increased in size, and without having acquired much brilliancy. At length its sides near the bottom gave way; and the light, now stronger, diffused itself laterally to a considerable extent. By and bye the stratum of clouds immediately over this expansion displayed the roseate hue of morn, and the whole heavens became (though yet faintly) illuminated. The rosy tints disappearing in their turn, were succeeded by a greater degree of pale light; and soon after, the near approach of the great luminary himself was announced by a pillar of red, or orange-red, light, which terminated in the orb now appearing large and fiery, through the medium of the horizontal morning air. This is the general course of sun-rise in India, as I have frequently witnessed since. The precursory phenomenon of the pillar of light, with the successive changes, being then new to me, appeared perhaps more interesting on that account.

At Pungrawah, the second stage from Banda, we find the rock of the same nature as those already described. In the march from this last place to the village of Kurtul, a range

of hills is seen in front, and on the left hand, much higher than any previously passed in the route, and which, instead of having peaked summits, are crowned with a flat table-land. About eight miles from the road, on one of the most conspicuous of these, to the left, stands the celebrated Fort of Callinger. We still find at Kurtul peaked hills composed of granite, similar to those at Banda, Gerawiah, and Pungrawah; and besides this, masses of a bluish-coloured trap are met with, and boulders scaling off in concentric layers. This trap-rock appears to have been at one time extensive, and I could trace a superficial stratum over the granite for some way up the hill. What remains of it rests on that rock without any distinct arrangement. The whole seems much affected by the action of the elements; and it is probable that, from this cause, a very large formation has been removed, and reduced to soil. Many of the granite-blocks here are also fast going into decay, and the soil of the district adjoining appears to be entirely derived from this source. Its colour is sandy-red, that of the felspar; and in this red sand, as a basis, are contained a great many small quartz-crystals, which still remain entire and unaltered in their structure. And the chalcedonic pebbles, found at the bottom of the hill, appear to have been imbedded in some rock, which had likewise at a former period rested over the granite. They are of the same nature as the pebbles found in the bed of the river Kane, so much admired on account of their beautiful variegated appearance and lustre when cut.

After leaving Kurtul, the road strikes into a wood of low trees, flanked on both sides by hills with flat summits; and, for the first time, we observe pieces of sandstone scattered over the path, mixed with broken blocks of granite, and the more complete detritus forming the soil. On one hill,

which is nearer than the others, we can distinctly see a horizontal position of the superior strata, and under the table-face, a sort of projection enlarging the diameter of the hill, which gradually increases to the bottom. The upper formation is evidently of the same nature as the detached pieces of sandstone found below; while the great body of the hill is composed of granite, (and perhaps trap), similar to that of the pyramidal hills formerly described. Some Fugueers, or religious devotees, take up their abode on this hill, at the junction of the sandstone with the granite formation; and the face of their caves, cut out of the solid rock, and *chinamed* (or whitened) over, together with the elevated platform, on which are placed the objects of their idolatrous worship, present, from the plain below, a very striking and conspicuous appearance.

On passing the Fugueers' Hill, we come in sight of the eastern extremity of the Fort of Adjyghur, like that of Callinger, crowning the summit of an isolated hill, and owing its principal strength to a table-face of sandstone rock. The sides of the elevation, or the declivities, are covered with jungle or bushy wood, composed of beautiful low trees, whose leaves exhibit every shade of green, and every variety of size and shape, from the pinnated and pointed leaflet of the tamarind to the broad expanded foliage of the teak,—which last appears to be very abundant in all those hills. Granite forms the great body of Adjyghur, and sandstone lies over it at the upper part, presenting a perpendicular face of rock to the height of between 30 and 50 feet all round, and constituting a natural barrier of defence, which of itself seems to render the place impregnable. The position of the sandstone is perfectly horizontal, and the rock is in general quite fresh.

The view from the ramparts of the Fort displays well

the peculiarity which I before remarked, respecting the want of general elevation in the whole of this mountainous tract. Hills are seen in every direction covered with jungle, rising abruptly out of an intervening flat country, the dull and cheerless aspect of which carries to the mind the idea of an uninhabited waste, or the haunt of savage beasts only. It is precisely the expression which DANIEL has given in the delineation of a fort in the Mysore, where a sort of sombre stillness (if I may be allowed so to term it) reigns, that no language can pourtray.

Adjyghur and Callinger are not less interesting to the antiquary, or mythological inquirer, than to the geologist; and the lover of art will find abundant subject of admiration in the beautiful remains of ancient Hindu architecture, which still exist within the walls of both these forts.

The country, for a short distance beyond Adjyghur, is open, and the soil again resembles that of the districts on the other side of Banda. A few miles farther on, we come to the village or hamlet of Besseramgunge, at the bottom of the Ghaut of that name. This Ghaut, or pass, leads from the low country of Bundlecund to the elevated table-land, on a level with the hills last mentioned. The path is cut through, or carried over granite, trap, and sandstone. At first, the ascent, though pretty steep, is not difficult, as there are few large stones, and no rock rising from the surface. Soon, however, it becomes steeper, and more obstructed, granite, trap, and sandstone masses presenting themselves in succession; and in many of the last may be perceived quartz-nodules included, like those found in the sandstone of the Table-Mountain at the Cape. The arrangement of the sandstone is in general horizontal, but at some points it appears to rise from the surface in the form of ridges almost vertical. The trap-rock exhibits no

well-defined arrangement, at the several points where it is found in the Ghaut; and I could not penetrate into the jungle here to examine the strata more extensively. It may, however, be inferred, that it is in every respect similar to that rock at Callinger, which I have since found lying chiefly in roundish masses, of various sizes, occupying the middle of the elevation, and composing the greater part of it. These are in general mouldering at the surface, and many of the smaller boulders can be reduced to powder without the assistance of the hammer. The larger masses are more compact, and possess great soundness of structure.

The Table-land here is elevated about 1200 feet, I should suppose, above the plain of Bundlecund. On reaching the top of the Ghaut, we cross one or two clear running streams, and some oozing rills and pools of stagnant water are met with, most of which indicate, by their blue, slimy, and iridescent surface, impregnation with the iron of the adjoining soil. This is indeed composed of ferruginous gravel and disintegrated sandstone; and if we may judge from the fine luxuriant grass growing over it, it must be one of great fertility.

The Tonng Punnah, celebrated for its diamond mines, is distant about eight miles from the Ghaut; and in my march thither, I passed several of the mines, which are here close to the road, and have even encroached upon it at different points. It being late, I determined to defer my examination of these till the following day, which I intended passing at Punnah. Early in the morning, my servants, who had been dispatched for the purpose, brought intelligence that they had observed the workmen going from the town to the westward, with their implements of labour on their shoulders. Following them, I soon reached the scene of

operation, distant about three miles, and in a situation perfectly corresponding with that on the other side of the town. It was a thin jungle (or wood), with long delicate grass growing in great abundance from a red gravelly ferruginous soil.

The mines are mere narrow pits, four, five, or more feet deep, according to the distance of the adjacent rock from the surface, and dug out of a ferruginous gravelly soil, which is of a dark reddish-brown, or blackish colour. It feels moist, and consists of fine sand, with a large proportion of small dark-red, and whitish or yellowish-white pebbles, the former appearing to contain a large quantity of iron. Three men were engaged in the search for the precious mineral when I arrived at the ground, the chief of whom very readily replied to all my questions, and explained and exemplified the series of operations gone through. These are indeed very simple. The soil, as it is brought from the neighbouring pit, is thrown into a small square excavation in the ground, about two or three feet deep, the bottom and sides of which have been well beaten, to prevent the gravel from adhering to them. A quantity of water being added, a man steps into the place, having an instrument like a broad hoe, with a short handle, (the common implement of the natives for all purposes), and mixes the whole together, using his hands also for that purpose, and tossing away all the larger pebbles which occur. This movement being continued for some time, the water is then thrown out by means of a small wicker-basket, and carries with it the sand, leaving the gravel behind. After repeated applications and discharges of water, the gravel is removed into another small bason of a circular figure, where it receives the last washing. From this it is conveyed to a large floor, on the surface of the ground, made of hardened earth, and there left to dry; the

finishing operation consisting merely of a minute examination of the dry gravel, by a person acquainted with the external character of the jewel in its rough state. Judging from the condition of the people employed, one would hardly expect that they could be able to detect a diamond: but they assured me they did so with the greatest ease; and it appears to be the lustre and transparency, even in this state, which directs them. The principal man picked out several pieces of transparent quartz from the gravel, which he said resembled the diamond. He had "found them of all colours and sizes; but the discovering them," he added, did "not depend on" his "skill or exertions, it was altogether the work of God,"—*sulaaming* at the same time, and pointing to the heavens.

From the inquiries which I made, diamond mining appears by no means a profitable concern at Punnah. Any one may dig, subject to paying the common duty of the fourth part of the produce to the Rajah, who is here, as in every other part of India, paramount lord of the soil. All stones, however, beyond a certain carat are claimed exclusively by him: but it may be supposed, where the means of concealment are so much in the power of the workmen, that the prince's treasury very seldom benefits much by this source of revenue. In the farm or spot which I examined, only two diamonds had been found during the preceding year, and these fetched each 200 rupees. The number of workmen commonly engaged in the various operations of digging, carrying, washing, and searching, is from four to five, though I saw only three. Of those, the sirdar, or chief, has a salary of five rupees *per* month, and the others four; and when a diamond is found, some present is made them by their master, proportioned to its value. So that, after paying the duty and expence of working, it is obvious, his gains, in this instance, must have been very small, and

not sufficient to induce him to persevere much longer in his mining operations. Indeed the business of digging appeared altogether at a stand when I passed the ground; and from the remains of pits in every direction, it must have been carried on much more extensively at a former period than at present.

Punnah is on many accounts an interesting place. Spacious tanks, that would do honour to the most liberal State, are seen surrounded by temples and palaces, neglected indeed, but displaying often the elegancies of architecture, and serving as monuments of former grandeur and magnificence. As a contrast to the picture, we have only to cast our eye to the town itself, and view the condition of the present inhabitants, which is wretched in the extreme.

To return to the geological facts. Red ferruginous gravel, the matrix of the diamonds, may be considered as terminating the regular formation of the hills in this part of Bundlecund. The order of arrangement, from below, upwards, being granite, trap, sandstone, and gravel.

Before proceeding to describe the situation of the other rocks, it may be worth while to look back on the ground travelled over, and take a comprehensive view of these four formations, as developed at the sites mentioned, whether singly or in combination, and also to consider the general qualities of the soil in the intermediate and adjoining districts.

The prevailing soil in Bundlecund, and indeed to the south of the Jumna, is the black coarse earth already alluded to, apparently consisting of a larger proportion of clay and carbonized vegetable remains, than is found in the land to the north of that stream. It retains moisture more perfectly than the common soil of Hindostan: hence arises its miriness in the rainy season, and its disposition to unite into hard masses, and form rifts and hollows during the

dry and hot weather. Even in its driest state, however, it has not the slimy compactness of pure clay-soils; but when separated into small pieces from the mass, is found to be quite friable, and easily reduced to powder. I think it probable that this contains also a proportion of magnesian earth, though, never having subjected it to chemical analysis, I am not warranted in drawing this inference from any accurate data. It is reckoned exceedingly fertile, and in no part of the Company's territories are more luxuriant crops displayed than in the districts where it predominates. Indeed, the richness of the Bundlecund lands, composed principally of this sort, is quite proverbial in India; and from its quality of retaining moisture, the process of irrigating them is less frequently resorted to, and the labour of the husbandman thereby lessened. It would appear, however, that greater exertions are necessary in preparing the soil for the seed, and also in keeping it clear of weeds, than we see applied to the common lands of Hindostan. A long grass was springing up every where at the time I passed through the district, and formed the only obstacle to the plough, which was then going in all directions.

One would suppose that the above characters of the soil should affect the climate, and render the plain of Bundlecund moist and unhealthy. As far as my own observation extends, agues are very prevalent in the whole of the low country, and sometimes prove so severe in European habits, as to require a total change of air for their removal; but the native population do not seem to suffer from any endemical diseases in a greater degree than the inhabitants of other parts of India; and their appearance, upon the whole, as presented to myself in passing along, rather indicated general good health and comfort.

This black soil has evidently been formed from the decomposition of some of the many varieties of clay-rock,

most probably from trap and amygdaloid, which at one time had rested over the granite in the hills of Bundlecund.

It is probable the rock at Gerawiah, and the trap formation observed on the hill of Callinger, and at Besseramgunge, have had their share in contributing to it. The vegetable matter with which the soil appears to be impregnated in a more than usual degree, may have been derived from extensive forests, which it is not difficult to conceive had flourished here at no very distant period; and the successive increase of a heavy, plastic, moist soil, covering the wood with each return of the rainy season, had also prevented its complete decay. For the amelioration or improvement of such a soil in Europe, the agriculturist would have recourse to lime, as rendering it drier, and reducing the vegetable matter which it contains, to a state more fitted for supplying the requisite pabulum to the growing plant. In India, however, such an expedient would not be attended with success, as calcareous earth, in this country, unites together into small masses, constituting what the natives term *Kunkur*, and does not mingle with the other ingredients of the soil, unless siliceous sand exist in an unusually large proportion. This isolation (if it may be so termed) of the calcareous earth, is very well seen in the Baitool Valley, in Berar, where the soil is essentially the same as the coarse black earth of Bundlecund. It is probable that a mixture of sand would be attended with a beneficial result; for wherever I have observed this combination from natural causes, the effect appears highly favourable. An illustration of this occurs in the route between Callinger and Allahaba, *via Turrawa*, where we approach the Jumna, and the alluvial sandy deposite of the river is seen mingling with the dark earth of the plain. From this union results a soil possessing every requisite

quality, and perhaps the best suited for grain-crops of any in India. The district in which it abounds well merits the poet's appellation of "*lætus ager*," and is certainly not inferior to his boasted "*Gargara*," in the ease with which it is cultivated, and the ample products it yields the husbandman in return.

From the appearance of the soil between Callinger and Allahabad, as I observed it in passing along, I could not help drawing an inference, which, if correct, may throw some light on the situation of the ancient capital of the Prasii. The city of Palibothra, we are told, was situated near to the hills, and at the conflux of the Ganges with another large river; and it is the difficulty of reconciling these two circumstances with any modern locality, which has given rise to so much discussion and disagreement among the learned. Indeed, no spot that I am aware of, in Hindostan, includes them both; for Allahabad and Patna want the former, and the neighbourhood of Bhungulpore, which Colonel Franklin endeavours to identify with the ancient city, is defective in the latter. We are therefore compelled to believe, that some change must have taken place in regard to the one or the other; and, as alterations in the course of the river are of daily occurrence, while the removal of mountains can only be effected by a great physical convulsion, or the agency of supernatural power, it is most reasonable to infer, that the junction of the rivers had occurred nearer to the hills, at a former period, than at present.

What is thus assumed, from a general view of the question, made with reference to the Jumna and Guna, appears to me to be confirmed by facts; and I think it exceedingly probable, that the latter river has at a former period flowed close to the front range of hills in the north-east extremity of Bundlecund, and that it has gradually forsaken that

course, as its earthy contents came to be deposited on the bank. At a short distance from the hills, we find the alluvion of the river mingling with the black earth; and long before we are out of sight of these, the soil seems almost entirely composed of a deposite from its waters. Granting, therefore, that the Jumna held its course farther to the south than the present bed of the river, we can easily conceive that the sister-stream of the Ganges may have joined its waters also more to the south and east than the present point of confluence at Allahabad, and in a situation so near to the hills, as to correspond in every respect with the account handed down to us of the site of Palibothra by ancient writers.

From the very cursory glance I could bestow on the district, in passing through it, I am not in possession of such exact information relative to the changes in the appearance of the soil as I could wish, and as would be necessary to form an accurate conclusion on this particular point. It appears to me, however, that were the existing geological relations of countries more attended to and studied, many disputed points in reference to their ancient history would be determined, and rules established, for the guidance of the antiquary, which would materially abridge his labour and research.

The other soils in Bundlecund are those formed from the debris of the granite and the sandstone rocks. The first is found at the village of Kurtul, and is very limited; the sandstone soil is seen between that village and Adjyghur—it is more extensive than the other; but as it abounds above the Ghaut, after passing Punnah, the account of its qualities will be best given along with the appearance of that district.

The appearance of the first hills, after entering the Jumna, has been already detailed. It is quite character-

istic of the granitic formation. Their outline, contrasted with the table-summits of the ranges in the interior, exemplifies in a striking manner the effect of the rock in the figure of the general elevation, from which, at the distance of many miles, we can often determine the nature and position of the strata forming very extensive ranges. The bare aspect of these granite piles, in the first range, and the irregular surface which they present, lead one to conclude, that they are but the remains of hills of a much greater extent, which have once existed here. They may be said to exhibit the *cores* of large hills, whose exterior has suffered in the lapse of time, while the more compact structure of the granite still enables it to resist the common causes of decay. I think it can hardly be doubted that all hills, similar to those met with in Bundlecund, have been originally formed by a force from below, elevating the primitive rocks, and causing a disruption of the secondary strata, at the several points at which it had been exerted. Where the force was but slightly impressed, and in a limited area, a small elevation would be formed. The granite would then only break through the superincumbent strata, without carrying them along with it, while the broken strata would rest on the sides of the mass, after the impelling force ceased to act. The figure of the hill then would not be a pyramid, which it now resembles, but would approach more to that of a cone; sandstone, trap, &c. lying on and surrounding the granite, and filling up its inequalities, and the direction of the strata of each of these deviating more or less from the horizontal line, in proportion to the elevation of the central mass. We could thus picture a hill more extensive than any of those now existing in the first series, whose sides at the surface were originally composed of sandstone ledges, and the summit of a pointed block or mass of granite, or, crowning the whole, may have existed a table-

land, of comparatively small dimensions. Their original height, in that case, may have been from 30 to 50 feet greater than their present, that being the average depth of the sandstone strata in the hills in the distance. Indeed both these ranges have been produced by the same causes, and have at the time been composed of similar materials; the sole difference arising from the size of the primitive or granitic base. The process of reduction or diminution of their bulk may be conceived to have taken place in the following manner. The sloping sandstone on the sides of the hill, being acted on by the elements of air and water, joined to the heat of the sun, had first suffered disintegration. The sand thus produced would be washed down by the torrents in the rainy season to the bottom of the hill, where it would spread out, and form soil. This operation continuing, the whole of the inclined sandstone would, in course of time, be removed, and the trap, or other rock, immediately beneath it, would thus be exposed in its turn. From the same causes which acted on the sandstone, this would also undergo a change, and ultimately be reduced to soil, which would spread over the detritus of the former. The small table on the summit, in the course of these operations, falling into fragments, and rolling down the hill, would also be exposed to the same successive changes; and thus, after the lapse of ages, nothing would remain but the central primitive granitic mass, as it is now displayed.

This view of the original structure of these eminences, and the changes which they have undergone, is supported by the present state of the larger hills in the distance. We see them covered by a table of sandstone still entire, resting on an extensive pyramid of granite, on the sides of which are found trap and pieces of sandstone, and, at the bottom, a soil composed of their detritus, being either a pure sand,

or a dark-coloured rich earth, according to particular localities.

It is obvious how the table-summits of the larger hills yet remain of great extent. Though at first exposed to the same decomposing action as the sloping strata, this could only go on for a short time. The surface of the rock suffering decomposition, plants of various sorts would take root, and grow and bind together the new soil; and shrubs and trees by degrees shooting out, would add to the effect of the herbage by affording a shade, and in so far obviate the influence of the sun's rays, in contributing to the process of disintegration. A deep jungle being in process of time produced, no farther changes would occur in the subjacent rock, excepting in its perpendicular faces, where the alternations of seasons might occasion fragments to be detached and precipitated to the plain below, or the descending water, in the rainy months, might wear out channels in the surface, and carry the sand to the bottom of the hill.

The ferruginous conglomerated gravel and sand met with here is entirely a secondary production, and the process by which it is formed resembles, in some respects, that of the calcareous Kunkur, to be afterwards described. It appears to be decomposed sandstone, united again by means of iron, in a low state of oxidation: I am also disposed to believe, that the iron has been derived, not from a mineral, but from a vegetable source; that it is, in fact, the product of decomposed ligneous fibres, which chemical analysis shows to contain a portion of this metal. The successive decay and production of vegetable matter would in time accumulate; the iron and the acid-water, also formed by the decomposition of vegetables, in the rain, would in part dissolve it, and impregnate the sand over which it rested. Evaporation taking place, on the ac-

cession of the dry season, would complete the process by the abstraction of the menstrual fluid; while the metallic oxide would enter into a more intimate union with the earth. The chalybeate pools at the top of the Ghaut, and oozing rills before mentioned, may be supposed therefore to constitute the active instrument in the formation of the ferruginous gravel.

It is remarkable, that the gravel-conglomerate should form the matrix of the diamond in Asia and America, and, I believe, in every quarter of the globe where the gem is found, while almost all the other precious stones are included in solid rock, of which they constitute, as it were, an integrant part, or are found along with its debris. How far this peculiarity may be connected with the singular chemical nature of the diamond, I cannot pretend to say; but the fact appears of importance in reasoning on the origin of this highly prized jewel.

With Punnah, we leave for some time all traces of cultivation, and enter upon a beautiful jungle, which continues nearly ten miles to the village of Kukurettee. The soil is entirely formed from the debris of red sandstone, without gravel, or apparently any impregnation of iron. It is of a red colour, dry, and fertile, and seems peculiarly adapted for the culture of the vine. To the right and left of the road, sandstone ridges, several hundred feet high, rise from the general level of the table-land, and present the same horizontal arrangement as the sandstone described. There is a perceptible elevation of the surface in this course, and the path appears to cross the range of hills, there being a slight descent as we approach Kukurettee; where the country again becomes open and cultivated, and displays the same dark-coloured earth which was so often met with below the Ghaut.

On the march from Kukurettee to the cantonment at

Lohargong, I discovered a mass of rock apparently consisting of alternate layers of limestone and sandstone; and soon limestone strata were found projecting from the ground, having, in many places, a very thin covering of soil, and scarcely any vegetation over it. The bareness of the plain here is altogether remarkable, and cannot fail to strike the traveller, after passing over the jungle district to the north. The effect of the limestone on the soil appears unfavourable. It does not undergo decomposition; and, in place of being soft and corroded like the sandstone, the strata, I observed, were exceedingly compact, and the surface of all the exposed masses rounded off, with a sort of semi-vitrescent structure, as if the rock had undergone fusion. The aspect of the whole district about the cantonment is barren and desolate, nothing but a reed or rushy grass being seen, and very little of the ground in a state of cultivation. It is not easy to discover the arrangement of this rock, as there are no elevations or ravines to give an opportunity of examining it minutely. The limestone formation, as I have since ascertained, is of great extent; traces of it are found about 70 miles to the west, on the Sangar route; and it is probable that it stretches to the bottom of the hills to the eastward of Lohargong, occupying the greater part of the basin inclosed, and formed by the ranges on both sides here.

A few miles to the south and west of Lohargong, the ground becomes more moist and clayey, and this change is quickly explained by the appearance of a coarse schistose sandstone, which I found very abundant here. It seems, however, to contain also a large proportion of calcareous earth. On crossing the Cane, near the village of Kopah, the thin horizontal layers of this rock are very conspicuous on each side, and the bed of the river seems to pass through it. The Cane here is rather more than 100

feet broad; but it was quite fordable in the latter end of October, when I passed it.

The village of Kopah leads directly to another range of hills, which rise out of the general table-land, and form the southern side of the basin of Lohargong. They are less abrupt than those passed between Punnah and Kukurettee; but their aspect, though not so striking, is much more beautiful, displaying every variety of shade in the foliage which covers them, and affording a rich and romantic diversity of prospect that is nowhere exceeded. The sandstone which composes them, like the former, is in general horizontal. From Kopah to Bisseenie is 18 miles, from Bisseenie to Syemnggur 10 or 12, and from this last to Bellaree as much more. The whole of the district is hilly, with numerous streams passing over it, and presents the same general features throughout. Specimens of a red-coloured decayed amygdaloid were taken from the hill above Bellaree, where it is very abundant, in the form of large masses, lying apparently over sandstone. On descending this hill, the country again opens before the view, and a large plain, with trees dispersed over it, is seen extending in every direction.

From Bellaree, to the next stage of Coreah, I travelled by night, and in consequence could not observe the appearance of the country. At one point, where the road passes over a small elevation, the rock projects from the surface in vertical ridges, in a singularly abrupt manner; and, as far as could be perceived by the feeble light of a waning moon, it partakes of the same general nature as the sandstone so often mentioned.

In the next march, quartz-rock was observed, and some beds of grey-coloured splintery foliated limestone adjoining to these, had a peculiar striped arrangement, and, in colour, lustre, and compactness, were not unlike the lime-

furnished from the detritus of limestone-rock, in the passage of the mountain-torrents over them, at no great distance from the head of the river, or at least within the first range of hills.

Near the town of Jubbulpore, we pass a ridge of granite rocks or hills, which resemble those first met with in Bundlecund, but which do not rise to the same height, and are less conspicuous from the greater continuity which they observe. Many of the masses approach to the gneiss formation, and they seem in general to be suffering a rapid decomposition. The cantonments at Jubbulpore are situated to the east and south of the town, on an open plain, which bears only a coarse grass, and a few shrubs or frutescent plants, if we except a decaying mango-grove in the centre of the building. The district around is rocky, and offers a fine field for the geological inquirer; but my short stay would only admit of a very cursory glance over it. A formation of sandstone, directly south of the cantonment, which appears to have been extensively quarried, has the peculiarity of being arranged in strata perfectly vertical, contrary to what is usually observed in the rock. A large mass of a whitish clay-rock, containing quartz-pebbles, forms the base of the hills, to the east of the plain. It appears to be washed down by the rains into powder, and formed anew into a boulder, or a cake, at the surface. The ridge lying over this, north and east, displays the primitive outline; and hence, I conclude, consists of the same granite-blocks which are observed at the entrance to the town from the north.

At Jubbulpore, we enter upon the great valley of the Nerbuddah, extending from the Forty Mundelah to beyond Hindra, through a space of at least 250 miles. The river, where we cross it at Tetwarra Ghaut, is a clear mountain-stream, not much wider than the Cane at Kopah, but of greater depth, being seldom fordable here before the

end of November. The bed is entirely rocky, and, in as far as I could judge in passing, the rock is a variety of trap, having a position nearly horizontal. A few miles lower down, I am informed, the river passes over a formation of marble, of the purest white colour, and with a granular structure. I met with some masses in the jungle soon after crossing the Nerbuddah, which appeared to be of the same nature. At the river, it is quarried by the natives, who make images and various religious ornaments of it. I saw a very large block in progress at the town of Huttah, in Bundlecund, when I left that part of the country, which the people told me had been brought from the Nerbuddah. It appeared equal to the finest marble I have seen in England, and might well come in competition with the admired Parian and Pentelic marbles of old, or the Carrara of modern times. The image which was then under the chissel represented the God *Sira*, or *Mah-ded*, (*Magnus Deus*), and his consort Bowannee; and though finished in the usual heavy style of the Hindoos, the execution was yet sufficiently delicate to display the excellence of the materials, which I admired greatly. The specimens of the rock, with many others, I regret to say, have been lost, through the carelessness of my servants, during my long march from the Nerbuddah; but I expect soon to be able to replace them, and transmit to you several others from that part of India, as a friend there has kindly undertaken to supply me.

The valley of the Nerbuddah is formed by two principal ranges of hills, which inclose it, and run nearly parallel to each other through its whole extent; the Vindhya, in the Malwa district, on the right,—and the Gondwana, in Berar, on the left. These are both composed chiefly of sandstone, the Gondwana displaying often perfect table-summits, with a horizontal arrangement; while the strata of the op-

posite range dip very considerably to the westward,—and this inclination is more conspicuous the farther we proceed in that direction, till we reach Hussingabad, when the angle with the horizon, in some instances, exceed 45°. Opposite to the Company's military cantonments at this place, the appearance of the sandstone strata cannot fail to strike the most indifferent observer. The hills rise from the west, like the waves of the ocean, gradually swelling, till they terminate abruptly to the east, with a perpendicular face, many hundred feet high. There is a small elevation to the south of the Nerbuddah, and in front of the Hussingabad cantonment, which displays the same arrangement, and has evidently been of cotemporaneous formation, though distant about five or six miles from the principal range. The rock is primitive sandstone, similar to that of the Bundlecund hills, and is in common use for building, for which it seems well calculated. Looking at those ridges of hills on the north of the Nerbuddah, and comparing their singular appearance with others of the same general structure, parallel to them, or even composing part of the same line, we cannot hesitate in pronouncing that they must have been elevated, or heaved up, from the horizontal position, by a subterranean force acting with *successive impulses*, and in all probability have owed their origin to a violent earthquake, which has happened at a period far beyond record or tradition, or perhaps even the existence of the human species. The earthquake which occurred on the 17th June last year, only wanted force to have raised a chain of hills of the same character, from one side of the base of the Indian Peninsula to the other, from the Gulf of Cambay to the bottom of the Bay of Bengal. It was a succession of *long heaves*, very different from what are usually experienced and denominated the shocks of an earthquake; the undulatory motion being prolonged and repeated over the

surface in such a manner, as to appear to have proceeded from a vast depth, and to have originated at a great distance from where it was felt by myself. This earthquake was general over India; but its sensible effects were most remarkable in the Guzerat district, where it seems to have been destructive, and to have created much alarm.

The Gondwana range of hills is considerably higher than the other, rising, near Sohagpore, to an elevation of 800 or 1000 feet (or probably much more, as I had no means of ascertaining this but from their appearance at a distance) beyond the level of the valley. I have been informed, by a friend, who entered these hills against the insurgents in the end of last campaign, that rich valleys lie between many of them, and an extensive table-land often covers their summits. The plain of Puchmerry, where the head-quarters of the Ex-Rajah Appah Sahib were fixed, during the rains of 1818, is an elevated table-land of this description, covered with the most beautiful verdure, and having many large trees scattered over its surface, reminding one of an English park more than a scene in the burning climate of Hindostan. Extensive beds of iron-ore were found here by the gentlemen who accompanied the troops; and from the appearance of the hills, I think it highly probable that they abound in various mineral productions. Iron is exceedingly scarce and dear in this part of India, and the reduction of the ore becomes therefore an object of importance. There is no want of wood to accomplish this, and I have every reason to believe that coal exists in the same hills, and near the situation of the ironstone. The specimens of coal sent, were found in the bed of the Towa river, which runs through these hills, and falls into the Nerbuddah, a few miles east of Hussingabad. I examined the banks of the Towa, where the specimens were got, but could not discover any appearance

of strata, nor impregnation, in the adjoining soil, and, from the rolled and worn surface of the pieces, it was evident they had been brought down by the stream from a distance.

The soil of the Nerbuddah Valley, all the way from Jubbulpore to Hussingabad, consists of a black coarse earth, like that of Bundlecund, having its surface strewed over with chalcedony and agates. It is very fertile, and, in some places, well cultivated; but a large portion of the country is jungly, and in a state of nature, deep forests extending from the bottom of the Gondwana hills to the river, which, in its whole tract, skirts along the opposite range to Malwa.

The specimens which I have now the pleasure to send, were procured chiefly from the Baitool Valley, in Berar, and the hills of the Gondwana range leading to it.

APPENDIX.

SECTION I.

Containing some Account of the Rocks found in the Baitool Valley, in Berar, and on the Hills of the Gondwana Range.

ON crossing the Nerbuddah Valley, at Hussingabad, we enter on those hills, about 15 miles to the south, near a village named Petrora. The intermediate space is partly cultivated, and partly in a neglected state, being overrun with a tall coarse grass, and having an occasional clump of shrubs or low trees. Its aspect is bare, and indicative of a deficient population, which indeed may be said to characterize the whole of the district. The hills are considerably lower here than to the eastward, being in general of a conical or dome-like figure, and covered to the summits with trees of the same low description as those of the Bundlecund range. They are composed partly of trap-boulders, especially the first met with; but the principal rock, all the way to Baitool, is harder and more compact than sandstone, but less so than perfect quartz. Its position is quite vertical; and this stratification is best seen in some ridges situate near the village of Teekaree, immediately after descending the Ghaut, which leads to the valley. At Shawpore, I found a very extensive formation of secondary limestone. There

are some cultivated grounds near that village; but with this exception, the whole road, for a distance of 50 miles, passes through one continued jungle, composed of a great variety of beautiful trees; among which, the *Cassia fistula* (the Awmiltass of the natives) is very conspicuous; and another tree, which yields vast quantities of the purest and most pellucid gum I have ever seen. At the time I passed through these hills, this last was destitute of leaves and quite bare, so that I could not determine its botanical characters. It attains a middling height; the branches shoot from the main trunk, much like the common plane-tree, and the bark is of an unusually dark colour. Vast quantities of gum, the produce of this tree, might be got in those hills, as it appears to be very abundant from the Baitool district as far west as Afsarghan.

After passing the quartz formation in Baitool, we come to granite, which is seen in large ledges or masses, and is principally remarkable for the great size of the felspar concretions. The granite disappears under rocks of secondary greenstone, which form the hills adjoining to the village or town of Baitool, and these rocks continue to form the bed of the Baitool Nullah, or rivulet, to near the town of Teekaru, where the granite again appears. The greenstone is sometimes amygdaloidal, and contains agates of various descriptions, and veins of calcareous spar and amygdaloidal green earth.

The soil of the valley appears to be directly formed from decomposed secondary trap-rock, and, at a little distance, it is difficult to distinguish the solid mass from the fresh friable earth. This soil resembles in every respect that of the Nerbuddah Valley, having a great variety of pebbles of chalcedony and agate scattered over the surface; and, besides these, there are met with, at different parts, round-

ed calcareous concretions, which are varieties of the kunkur formerly alluded to. On breaking these, we find them hollow, and the internal surface studded over with crystallisations of calcareous spar.

Coal occurs in the bed of the Towa, about eight miles east from Hussingabad. I found many pieces of the same coal near the junction of the river with the Nerbuddah, but they had all been brought down by the stream from the hills, where it is probable extensive beds of this combustible exist: and from the fact of ironstone also abounding there, and the extreme dearness of the metal, it becomes an object to explore the whole surrounding hilly country, and to trace the course of the river, in order to discover the situation of the mineral.

SECTION II.

Remarks made on a March from Hussingabad to Saugor, and from thence to the Ganges.

The specimens labelled "*From Mukwah*," were picked up by me on a hasty march which I made from Hussingabad to Saugor, and thence to the Ganges, in my way to this place. I had no leisure to examine the geological features of the country minutely; but the few memoranda which I noted down at the time, defective as they are, may still give some general idea of the nature of the rocks. I shall therefore transcribe them without alteration.

10th December 1819.—From Hussingabad, for two or three stages, Sandstone; near the Nerbuddah, singularly elevated towards the east, forming an angle of upwards of 45°, with an abrupt face gradually falling off to the west.

12th & 13th.—About half way in some of those marches, a rock at the surface, resembling the trap of Baitool, and containing veins of calcareous spar.—Black clay earth in the plains.—Hills of moderate height.—Abundance of agates and chalcedony in this clay soil, and evidently derived from the decomposition of the greenstone rock.

22d.—Saugor. The appearance of the rocks to this place continue all the way as already described. At Saugor, however, trap is very abundant, forming large ridges, and mingling with sandstone. On the plain, in front of the cantonments, a conglomerated sandstone, containing fragments of quartz, of a red and grey colour; and in the soil, saw masses of radiated and fibrous calcareous spar.

26th.—From Saugor to Huttah, in Bundlecund. Trap twelve miles to Sanonda, first march.—A singular white rock, near Puterea, between that village and Saipore, appears to be flesh-coloured flint, decomposing at the surface. Sandstone at Puterea. Between Puterea and Mirsinghur cross the Sonaur river, the bed of which is grey-coloured compact secondary limestone, apparently of good quality; occasionally schistus, and much mingled with the calcareous rock, particularly as we approach Mirsinghur: this schistus in horizontal layers.

From Mirsinghur, plains showing limestone at the surface, and coarse schistus, with occasional sandstone; farther on, sandstone predominating, and giving the character to the country, in the bleak aspect, and aptitude for the resort of bustards, in this respect resembling the plain at Lohargong.

31*st.*—At Huttah, chiefly limestone. At the cataract on the Sonaur, the arrangement is well seen, consisting of alternate layers of soft schistus and limestone. The limestone very impure, containing fragments of quartz and sand, and occasionally a mineral like felspar. All the way to Lohargong, limestone abundant. Cross the Cane river, from the bed of which I procured the pebbles herewith sent. One or two of these are cut and polished, as finished by the native workmen at Banda.

IV.—*Notices regarding the Fossil Elephant of Scotland.*

By Robert Bald, Civil Engineer, F. R. S. E., M. W. S., G. S. L., &c. &c.

(*Read 24th February* 1821.)

In the observations which I had the honour of reading before this Society, the year before last, regarding the Clackmannanshire Coal-field *, I remarked, when treating of the alluvial cover which rests upon the rocks, that it consisted of two very distinct kinds, which are termed the Old and Recent Alluvial Covers, and this observation applies to every district of Great Britain which I have examined. That termed Recent, is found along the sides of rivers and lakes, is frequently of considerable extent, generally very fertile, and, along the river Forth, it is in some places 90 feet in depth. It contains great abundance of organic remains, both of the animal and vegetable kingdoms, a circumstance familiar to every observer. This cover is visibly forming and extending every day.

On the other hand, the Old Alluvial Cover is of vast extent, occupying a great proportion of the surface of Great

* Wern. Mem. Vol. iii. p. 123.

Britain; is found at great heights, also under the level of the sea; and is of three kinds, *viz.* 1*st*, Sand; 2*d*, Gravel; and, 3*d*, Clay. The clay is of two kinds, *viz.* 1*st*, fine plastic clay, such as is used by potters; and, 2*d*, clay intimately mixed with sand, gravel, and boulder-stones; which last are sometimes found several tons in weight. It is this last kind of cover which at present I particularly refer to.

I have had very frequent opportunities of seeing this kind of cover laid open from the surface, to the rock on which it rests, and have found it in thickness from a few inches to 160 feet; and have always remarked, that though it contained boulder-stones, and gravel of almost every kind of rock, and detached angular fragments of the adjoining rock-stratification, I never had observed a single instance of an organic remain of any kind in it. This cover is known in Agriculture by the name of Till, and is impervious to water. The soil which covers it is generally thin, and not naturally fertile; of itself, it is indeed one of the most sterile subsoils which is known. The first plant which most frequently strikes root upon it, after exposure to the air, is the common thistle, *Carduus arvensis*.

As the Union Canal, which is now making betwixt this city and Falkirk, passes for 28 miles through a country chiefly composed of this kind of cover, I took the opportunity of noticing if any organic remains were found in it; and I requested my friend, Mr Hugh Baird, civil engineer, who directs the canal operations, to be particular in his inquiries if any such remains were found, and to give me notice. Having been frequently along the Canal with him for these last three years, I had an opportunity of investigating the excavations as they proceeded. No appearance of any animal or vegetable remain, however, was found, until the 18th day of July last, when the workmen, who were cut-

ting the Canal, in the west park of Cliftonhall estate, having undermined a large bench of earth, it fell, and a substance, which the workmen conceived to be the horn of an animal, was found amongst the earth, which, as a matter that attracted their curiosity, they laid in a cottage adjoining.

Two days after this, in going along the Canal, I met with Sir ALEXANDER MAITLAND GIBSON, who informed me that a singular remain of an animal had been found in cutting the canal through his estate; and he politely accompanied me to the cottage, that I might see it. On its being produced, I found it to be an ivory tusk, in most complete preservation. After taking its dimensions, and making a drawing of it, I went to the spot where it was found, and questioned the workmen particularly concerning it. According to their information, the spot where it was inclosed in the earth was from 15 to 20 feet from the surface: the earth or cover was of the strong old alluvial earth before described, and at the point where the banks begin to decline, and form the immediate narrow valley through which the river Almond runs. In the upper part of the earth where the tusk was found, I observed fissures about five inches wide at the top, and ending like a wedge below, formed by rents in the clay, and filled with sand. I have, however, reason to conclude, that the tooth had not been in the sand-veins, but inclosed in the clay; for, otherwise, it could not have been in such a complete state of preservation. From the close texture of the clay, and being so impervious to water, the tooth might, I think, have remained for ages in the same state. This spot I afterwards had the pleasure of examining, along with Professor JAMESON, when I pointed out to him the situation where the tusk was found.

The tooth weighed, when washed, 25$\frac{5}{8}$ lb. avoirdupois, and measured as follows:

Length,.................................. 39 inches.
Circumference at the middle,.......... 13 do.
Circumference at the thick end,....... 13 do.
Circumference near the small end,.... 12 do.
And the inside curve deflected from the cord-line 4 inches and $\frac{2}{10}$ths of an inch.

As the specimen interested me much, more particularly as it was the only instance of my having found any organic remain in this kind of cover, I suggested to Sir ALEXANDER MAITLAND GIBSON to take particular care of it. He accordingly told the workman who found it, to send it to the house of Cliftonhall, where he would give him a gratuity for it. The workman, immediately upon understanding that what he conceived to be a horn, was ivory, and very valuable, went off to Edinburgh with the tooth, and sold it. Sir ALEXANDER, the instant he heard of this, went in search of it, and found it in an ivory-turner's, who had given L. 2 for it; but, most unfortunately, before he arrived, it was sawn across in three places, and part of it prepared for the lathe, to form chess-men; which circumstance shews the high state of preservation in which it was found. Sir ALEXANDER repaid the money which had been given for it; and he has, in the most obliging manner, permitted me now to exhibit it to the Society.

It is now five inches shorter than when I measured it, owing to the piece cut out of it by the turner; but I have herewith produced a drawing of it, shewing the exact dimensions when found.

PLATE IV. Fig. 1 & 2.

Circumference at a	....	13 inches.
Ditto at b	....	13 do.
Ditto at c	....	12 do.
Depth of hollow	....	7 do.

The air has now begun to operate upon the tooth; it has shrunk considerably, and is formed into longitudinal concentric rings. When first cut across, it was quite solid: this circumstance proves how completely it had been excluded from the action of air or water, otherwise it must have decayed long ago.

I have frequently mentioned to naturalists the observation I had made of no trace of organic remains being found in this kind of cover; and this is the more remarkable, as in the coal-fields, where it rests on rock, the strata abound with impressions, and casts of plants and shells; and the shistus at Cliftonhall abounds with delicate and beautiful impressions of the former. To this observation I have received for answer, that probably both plants and animals may have been at one time in this kind of cover, but are now decayed. Had this been the case, some faint traces of them would have remained, and the clay would consequently have had some of the principles of the fertility of the recent alluvial covers. But this is not the case in the least degree. Besides, from the specimen now exhibited, its quality of preserving organic remains is very manifest.

There are instances, however, where I have seen large trees inclosed in this kind of cover by the sides of rivers: this is easily accounted for. Such trees have grown on the banks of the river: the floods have undermined them, and the trees, after falling, were overlaid by succeeding falls of the bank, and in such a manner as to secure them from either the action of air or of water. Such trees, when taken out, are as solid and hard as when they were growing. I saw an instance lately of an oak-tree taken out of a bank of this kind at Yester, near Haddington; it was very black throughout, and so close in the texture, that it was made into ornamental furniture, which had the appearance of ebony. With this circumstance in view, I examined the

situation of the ground where the tusk was found; but it could not, in my opinion, have been covered with earth from a high bank, as it was at the top of the river-bank where the table-land commences.

This specimen being an anomaly in the general observations I have made as to organic remains, I can offer no hypothesis on the subject, nor form any idea as to the period when this tusk had been deposited. We know such specimens are found in a bed of clay in the vicinity of London, but the clay is altogether different from that at Cliftonhall. All these specimens refer to a period very remote, as to which many ingenious theories have been brought forward, without, however, producing any satisfactory conclusion.

As to this old alluvial cover, I am led to think, from many observations, that it has been gathered together by a violent and sudden convulsion; and my chief reason for concluding so is, from the intimate, yet heterogenous mixture of clay, sand, and boulder-stones, while the sharp angular fragments of the soft strata adjoining, such as sandstone, shistus, and coal, shew, that there had been a tearing up of the strata; but the deposit made so instantly, that there was not time for the attrition of these soft fragments. Besides, had it gradually subsided, there would have been traces of beds or divisions in it, and the stones would have been all towards the bottom of it, upon or near the rock head: but this is not the case; large and small boulder-stones are found mixed alike through every part of it. Horizontal beds of sand seldom occur.

The only other instance I know, of elephants' tusks being found in the alluvial cover in Scotland, was in the parish of Kilmaurs, Ayrshire, near the Water of Carmel, in a property belonging to Lord EGLINTON. They were dis-

covered in the beginning of January 1817, by Mr ROBERT BROWN, tacksman of the sandstone quarry of Greenhill, while removing the earth above the rock. At the depth of 17½ feet from the surface, he discovered two tusks, one of which measured 3 feet 5½ inches in length, and about 13½ inches in circumference. The other was similar, but so much decayed that it could not be preserved. The alluvial cover was clay; but where the tusks were found, it was much changed in colour, being of a dark-brown, and, when turned up, had a most offensive smell. The colour of the clay, excepting at the spot around where the tusks were found, is of a very light-brown, which rendered the change of colour very distinct.

The tusks were found lying in a horizontal position, with several small bones near them: and it is particularly to be remarked, that several marine shells were found amongst the dark-coloured earth.

The tusk weighed 20½ lb. English weight, and was sent to the Earl of EGLINTON. It was afterwards cut through across, and one part of it is to be seen in the saloon at Eglinton Castle; the other part was sent to the College Museum at Edinburgh.* The part which is at Eglinton Castle I have also examined. The exterior is of a brown colour, and very hard; but the greater part of the interior is much decomposed, has lost the ivory texture, and, though not absolutely soft, is similar in appearance to half-rotten wood.

From what I have stated regarding these tusks found at Kilmaurs, we have reasons to draw the following conclusions; namely, That the entire animal had been deposited in the spot where the tusks were found; and that

* See Pl. IV. fig. 3. (same scale as fig. 1. 2.)

the cover of the rocks, where they were found, was not of the old, but of the recent alluvial cover: the offensive smell, and dark-coloured earth, proved the one point; and the marine shells the other. Hence, the tusk now before the Society, and those found at Kilmaurs, must have been deposited under circumstances totally different, and at periods, in my opinion, very remote from each other.

Further, as the dark colour of the earth, and the offensive smell, where the bones were found, support the conclusion that the entire animal had been deposited there; and as we know that, some years ago, the entire body of an elephant was found in a mass of ice in Siberia, and in such a high state of preservation, that the hair remained on the skin,—and the flesh of it, when thawed by the sun, was readily eaten by the dogs,—the hair was short, partly long, and partly woolly, altogether different from that of the present elephants found in Asia and Africa; and as the bones of the elephant are found frequently in the great bed of the London clay, at a considerable depth under the surface, may we not, with reason, infer, that a species of elephant did once exist in northern latitudes, and in Great Britain, whose habits suited a northern climate—and that the tusks found at Cliftonhall and Kilmaurs did belong to this species? This conclusion appears to be still further supported by the fact, that the tusk found at Cliftonhall differs from the present elephants' tusks brought to this country, in having a deep hollow at the small end. This may possibly be accidental; but I am inclined to regard it as characteristic: for, some years ago, I had an opportunity of examining above a hundred tusks of the common elephant, in the possession of Mr JOSEPH GURNEY, ivory-merchant, Sheffield, the whole of which had the ordinary obtuse point, and not one of them presented any hollow at the small end. I may take this opportunity of mentioning,

that one of these tusks, which had been sawn across, was very remarkable, having, in the heart of the solid ivory, a leaden musket-bullet, which must have been lodged when the tusk was soft at the root, the animal having been shot at and wounded when young. The ivory around the ball was a little discoloured, and cellular; but there was no opening from the root to the place where the ball was inclosed. The former species, whose habits suited a northern climate, has become extinct, from causes as to which we can form no reasonable conjecture *.

* To Mr George Johnston, factor to Lord Eglinton, I am indebted for the particulars regarding the interesting fossil found at Kilmaurs. An account of the finding of these tusks was sent to Professor Jameson by Alexander Hood, Esq. surgeon, Kilmarnock, and read before the Wernerian Natural History Society, 20th December 1817.—See Wernerian Memoirs, vol. iii. p. 525.

V.—*Descriptions of Seven New Scottish Fungi.*

By ROBERT KAYE GREVILLE, Esq. F. R. S. E. M. W. S. &c.

(*Read 29th December* 1821.)

THE number of Fungi hitherto discovered in Scotland is so very limited, that little merit can be claimed for adding a few additional species; yet when a *new* one is ascertained, or one respecting which there exists any degree of confusion, a description of the one, or observations calculated to remove uncertainty in the other, will, it is presumed, be not unfavourably received. Under this impression, I have described several species, which I have recently added to the Scottish Flora. No figures have been published of any of them; one is described by ALBERTINI and SCHWEINIZ in their *Conspectus Fungorum*; and two are so obscurely noticed, that, were it not for colour and locality, I should have no data by which I could judge of their identity.

Since PERSOON published his *Synopsis Methodica Fungorum*, in 1801, a great number of Species have been discovered, and many necessary alterations made in the Genera, particularly of the sixth Order, NÆMATOTHECII *Fungi*

byssoidei. The number of genera here has been more than doubled, chiefly by the exertions of the German Cryptogamists; in most instances upon a sufficient foundation, although in some their distinction of specific character seems to be somewhat trifling; as between *Virgaria* and *Haplaria*, *Polyactis* and *Aspergillus*, *Verticillium* and *Botrytis*, *Rubigo* and *Erineum.*

The following plants belong to the order above mentioned, and I have been obliged to adopt the new genera, as no others would receive them; those, however, to which my specimens must be referred, are distinct and satisfactory.

SPOROTRICHUM, *Link.*

Fila ramosa implexa sporis globosis aut ovalibus vage inspersa.

Sporotrichum minutum, *mihi.*

Plate V. fig. 1.

S. subrotundum minutum candidum, filis laxe intricatis sporis numerosis ovalibus.

HAB. In stercore, autumno hyemale.

Small, very white, tufted, sometimes crowded together, tufts about half a line in diameter. Threads under the microscope, loosely interwoven, seldom and irregularly branched, and somewhat attenuated. Sporules oval, or suboviform, very numerous, and not so small as in many species. At Braid Hermitage, on dung.

Sporotrichum tenuissimum, *mihi.*

Plate V. fig. 2.

S. candidum latum telæforme, filis dense intertextis tenuissimis sporis globosis sparsis minutis.

HAB. In ligno mortuo, autumno.

Pure white, and adhering so close to the wood, that, with the naked eye, it was impossible to say whether it was a fungus or a lichen. Very broad, and following the inequalities of the surface on which it grows. Threads very fine, and seldom branched. Sporules round, very minute, somewhat scattered. Found on a piece of dead and rather dry wood, growing chiefly on the bark; Braid Hermitage.

Sporotrichum sulphureum.

Plate V. fig. 3.

S. sulphureum cæspitosum, filis laxe contextis sporis numerosis subglobosis.

Monilia sulphurea? PERS. Syn. Fung. p. 691.
ALBERT. et SCHW. Conspect. Fung. p. 346.

HAB. In stercore et in cellariis, toto anno.

Tufted, roundish, of a pleasant yellow colour, varying in shade according to age. Tufts from half to two lines in breadth. Threads remotely jointed, loosely interwoven, and occasionally branched. Sporules globular, rather numerous.

This plant is by no means uncommon, frequently growing along with the following species, in damp cellars, upon various substances. A short time ago, I received from Dr BREWSTER a specimen of this and *S. aureum*, growing together on a wine cork; and a few days afterwards, met with them on dung in the neighbourhood of Edinburgh.

I dare not venture to pronounce this plant the *Monilia sulphurea* of PERSOON: his whole character is comprised in the words "*cæspitosa sulphurea*;" and the little use he seems to have made of the microscope, renders the point still more doubtful.

Sporotrichum aurantiacum, *mihi*.

Plate V. fig. 4.

S. cæspitosum aureum, filis tenuissimis valde contextis sporis globosis sparsis minutissimis.

Monilia aurea? PERS. Syn. Fung. p. 691.
ALBERT. et SCHW. p. 363.

HAB. In stercore et in cellariis, &c. toto anno.

Tufted, of a beautiful orange colour, which acquires a reddish tinge in age. Tufts generally about a line in breadth, but sometimes almost confluent. Threads very fine, branched, and much entangled. Sporules globular, scattered, and very minute.

The same degree of uncertainty envelopes this species, as *S. sulphureum*. PERSOON's character is only "*cæspitosa aurea*;" but from the striking similarity of colour, it is probable that both plants are what PERSOON has described with so much brevity, and under the same specific names, under the genus *Monilia*.

It appears very distinct from *S. aureum* of LINK, in the *Berl. Mag.* 7. 13.

PENICILLIUM, *Link*.

Flocci simplices aut ramosi, apicibus dilitatis finduntur in fasciculum, ramulorum capitulum sporarum globosarum colligentem.

Penicillium candidum, *Link.*

Plate V. fig. 5.

P. fila sterilia decumbentia implexa, fila fructifera erecta simplicia subsparsa capitulis sporarum albis.

Penicillium candidum, Link. *in Berl. Mag.* 3. 17.
Gray's *Nat. Arr.* v. i. p. 554.*

Hab. In caulibus subputridis plantarum, autumno.

This species forms whitish spots of half to one inch long, by several lines wide, upon the semiputrid stems of herbaceous plants. On these spots the little pure-white heads are very visible to the naked eye, dispersed in a scattered manner over the surface. The threads are simple, erect, and remotely jointed, dividing at the summit into two; and then subdividing into a number of short attenuated ramuli, covered with a profusion of sporules. Sporules round and minute. The barren threads have the same character, except being decumbent, simple to the very summit, and producing no sporules.

This species was found on the decaying stem of *Arctium Lappa* near Edinburgh.

Stachylidium, *Link.*

Flocci adscendentes basi implexi; ramulis superne verticillatis, abbreviatis obtusis. Sporæ globosæ ad verticillos congestæ.

* Gray's Natural Arrangement of British Plants, 2 vols. 8vo. 1821,—a most extraordinary work, of great industry, but of less judgment, in which *Jungermannia* alone is split into 19 genera.

Stachylidium candidum, *mihi.*

Plate V. fig. 6.

S. fila ramosa erecta remote articulata candida sparsa sporis globosis.

HAB. Ad lignum mortuum, autumno.

Spreading over rotten sticks and dead wood for an inch or more together, but in somewhat a scattered manner. Under the microscope it is a beautiful object. The threads, which vary considerably in diameter, are remotely jointed, and attenuated at the base. The upper half is regularly verticillate, the whorls being formed by four short and obtuse ramuli; one of these ramuli sometimes becomes a branch, and is then whorled in the same manner. The sporules are small, globular, and collected at the whorls.

BOTRYTIS, *Link.*

Flocci erecti, basi sæpius implexi ramosi, ramulis corymbosis, circum apices sporas globosas colligentibus.

Botrytis diffusa, *Albert. et Schw.*

Plate V. fig. 7.

B. candida ramosa, ramis longe lateque diffusis ramulis undique in racemos dispositis racemuligeris.

ALBERT. et SCHW. Conspect. Fung. p. 362.

HAB. In caulibus semiputridis plantarum, autumno.

An incomparably elegant and beautiful plant, and much larger than any of its congeners. It forms large spots, of two or more inches in length, of the purest white imaginable, which, when examined, consist of a number of separate tufts, two or three lines in height. The threads are

naked towards the base, but, immediately after dividing and subdividing into a few branches, become clothed at nearly regular intervals, with small pedicillated clusters of minute globular sporules. After dividing into branches, each thread is continued simple and slender to its summit, and is disposed in the most graceful curve.

My specimens were gathered on a stem of *Arctium Lappa*; those of ALBERTINI and SCHWEINIZ on that of *Solanum tuberosum*.

Edinburgh, December 31. 1821.

Explanation of Plate V.

Fig. 1. Filaments and sporules of Sporotrichum minutum, very highly magnified.
2. Do. of Sporotrichum tenuissimum, do.
3. Do. of Sporotrichum sulphureum, do.
4. Do. of Sporotrichum aurantiacum, do.
5. Do. of Penicillium candidum, do.
6. Do. of Stachylidium candidum, do.
7. Do. of Botrytis diffusa, do.

VI.—*Meteorological Journal, kept at Clunie, Perthshire, for Twelve Years, from* 1809 *to* 1820.

By the Rev. WILLIAM MACRITCHIE of Cluny, Perthshire.

(*Read 14th April* 1821.)

To Professor JAMESON.

Clunie Manse, 15*th February* 1821.

DEAR SIR,

I HAVE been at considerable pains to keep a Register of the Weather here, as exactly, every day, as possible, for the last twelve years. The thermometer was observed regularly at nine o'clock in the morning, and at eleven at night; and the barometer regularly at twelve o'clock noon. The height of both instruments above the sea-level is about 190 feet; and the distance from the nearest point of the German Ocean is about 36 miles on the parallel of latitudes, which is about 56° 35′. Clunie Manse is about 10 miles west of the meridian of Edinburgh, near the foot of the Grampians.

I have sent you herewith a set of Tables, carefully, and I hope accurately, made out from the monthly columns of

the Register. In order to shew you, as distinctly as possible, the medium temperature and pressure of the atmosphere here, at the hours of observation, I first took the two extremes of each monthly column of the Register, and adding these together, and dividing their sum by 2, obtained the medium, as you see it marked in the *left* hand columns of the tables for each year. In the next place, that I might ascertain more clearly the medium for each year, I summed up each monthly column with great care, and dividing the sum by the number of days in the month, obtained the medium as you find it marked in the *right* hand columns of the tables for each year. The rest of the tables will explain themselves.

I am, &c.

W. MACRITCHIE.

TABLES

Shewing the Temperature *and* Pressure *of the* Atmosphere, *at Clunie Manse, for Twelve Years.*

	Monthly average temperature, at 9 o'clock A. M., taking the two extremes.	Monthly average temperature, at 11 o'clock P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
1809.	°	°	°
January	24½	24½	29,9
February	38	39½	29,9½
March	40½	41½	30,2
April	44	38	30,2¼
May	53	46½	30,1
June	57½	49½	29,9
July	61½	53	30,1
August	60½	54	29,8½
September	50½	48	29,8
October	48½	45½	30,1½
November	39	39	29,9
December	33	38½	29,2¾
Yearly aver.	45	43½	29,9½
1810.	°	°	°
January	35½	34	30,0½
February	36	35½	29,8¼
March	39	34½	29,7¼
April	47½	41	29,8½
May	51½	41½	30,0
June	59½	52	30,0¾
July	59½	52	29,8¼
August	58½	56	29,8
September	55	52	29,9¾
October	48	45½	29,7¾
November	39½	38½	29,8¼
December	34½	35½	29,8
Yearly aver.	47	43½	29,8¾

	Monthly average temperature, at 9 o'clock A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly average pressure, at noonday, adding the columns.
1809.	°	°	°
January	29½	25¼	29,8¼
February	37¾	37¼	29,9¼
March	42¼	40½	30,2¼
April	42½	37½	30,2¼
May	54¼	47¾	30,1¼
June	58¼	52	29,9¼
July	61¼	54¾	30,1½
August	58¾	54¼	29,9
September	53¼	50	29,8¼
October	49	47¼	30,1¾
November	38¾	37¾	30,0¼
December	34½	35¼	29,5
Yearly aver.	47¼	43¼	29,9¾
1810.	°	°	°
January	35¼	35½	30,0½
February	35½	35¼	29,7¾
March	37¼	34¼	29,7¼
April	45½	41	29,8½
May	50½	41½	30,0
June	60¼	52	30,1
July	60¼	53	29,8
August	59¾	53½	29,8¼
September	55¾	51	30,0¼
October	47¾	45¼	29,9½
November	39	37¾	29,6¼
December	33	34¾	29,6½
Yearly aver.	46½	42¾	29,8¾

TABLES continued.

1811.	Monthly average temperature, at 9 A. M., taking the two extremes.	Monthly average temperature, at 11 P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
January	33½	39½	29,6¾
February	35	34½	29,6½
March	44½	41½	29,9½
April	44½	39	29,7¾
May	54	46½	29,8¾
June	60	52½	29,8½
July	63½	55	29,9¼
August	58	53½	29,8½
September	54	50	29,8¾
October	48½	49½	29,6
November	41½	41½	29,7½
December	39½	39½	29,6¾
Yearly aver.	48	44¼	29,8½

1812.			
January	34	35½	29,7
February	39	36	29,5
March	37½	33½	29,9
April	40½	36½	29,8½
May	51	42½	29,9¼
June	63½	52	29,9½
July	59½	52½	30,0
August	57½	51½	29,9¾
September	53½	48	30,0
October	46½	46½	29,3¼
November	39	35½	29,8¾
December	36½	37	30,0¾
Yearly aver.	45½	42¼	29,8¼

1811.	Monthly average temperature, at 9 A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly average pressure, at noonday, adding the columns.
January	33⅔	33½	29,8¼
February	35¼	35	29,4¾
March	43	39¾	30,0¼
April	45½	41¾	29,8¼
May	55	47¾	29,8¾
June	59½	51¼	29,4¾
July	62½	54¾	29,4¾
August	58½	52¼	29,6¼
September	51½	50¼	29,4¼
October	51¼	49¼	29,5¼
November	42	42	29,7¾
December	34¾	35¼	29,6
Yearly aver.	47⅔	44½	29,6¼

1812.			
January	34½	34	29,7¾
February	38	36¾	29,5¼
March	33¾	34¼	29,8¼
April	41¾	36¼	29,9¾
May	50½	44¾	29,8¾
June	59¼	50¼	29,9
July	58½	51½	29,9¾
August	58½	52¼	30,0¼
September	54¾	49	29,9¾
October	47	46¼	29,5¼
November	38½	37¼	29,8¼
December	34¾	35¼	30,0
Yearly aver.	45	42¼	29,8½

TABLES continued.

	Monthly average temperature, at 9 A. M., taking the two extremes.	Monthly average temperature, at 11 P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
1813.			
January	34°	31½°	29°,9
February	40½	39	29,6½
March	44	39½	30,0
April	43	38½	29,9¾
May	50½	45½	29,7½
June	61	50½	30,0¼
July	62½	53½	29,9¼
August	60	53	30,0½
September	53½	50½	29,8¼
October	43½	40½	29,7
November	34¾	36½	29,6½
December	35	35½	29,7½
Yearly aver.	47	42¾	29,8½
1814.			
January	25½°	24½°	29°,6
February	30½	27½	29,7½
March	40½	38	29,7½
April	52½	43½	29,7¼
May	52	43½	30,1¼
June	55	49	30,0¾
July	62½	53	29,8¼
August	59½	54	29,9
September	55½	40	29,9¼
October	44½	43	29,8½
November	37	37½	29,8½
December	32½	37½	29,5½
Yearly aver.	46	41¾	29,8¾

	Monthly medium temperature, at 9 A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly medium pressure, at noonday, adding the columns.
1813.			
January	32¼°	32¼°	29°,9¾
February	38¾	38	29,5¼
March	43½	40½	30,0
April	45½	40¾	29,9½
May	51¾	45½	29,7¾
June	61	50	30,0½
July	62¼	55¼	29,8¾
August	61¼	52	30,0¾
September	54½	51½	29,9¾
October	43¼	41¼	29,7¼
November	36½	36¼	29,6¼
December	36	36	29,8
Yearly aver.	47¼	43¼	29,8½
1814.			
January	27¼°	25½°	29°,6¾
February	34¼	32½	29,9½
March	37¾	35½	29,8¼
April	49½	44½	29,7¾
May	54¾	43	30,0¾
June	57	48¼	30,0½
July	61¾	54¾	29,5½
August	59½	56	29,8¾
September	55½	49¾	30,0¼
October	45¾	43	29,7¼
November	39	38	29,6¾
December	34¾	35¾	29,6¼
Yearly aver.	46½	42¼	29,8¼

TABLES continued.

1815.	Monthly average temperature, at 9 o'clock A. M., taking the two extremes.	Monthly average temperature, at 11 P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
January	31°	29½°	29°,9
February	40	40	29,7¾
March	41½	39	29,7¼
April	44¼	42½	29,9
May	55½	48	29,9½
June	60½	52	29,8¼
July	62½	54½	29,9
August	61½	55	29.8¼
September	58	49	29,8
October	48	43	29,7½
November	40	42	29,6
December	30½	28½	29,5¾
Yearly aver.	48¼	43½	29,8

1815.	Monthly average temperature, at 9 A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly average pressure, at noonday, adding the columns.
January	32¾°	33°	29°.9¾
February	35¼	34	29,6¾
March	41¼	38¾	29,6¼
April	46¼	42	29,9¼
May	54	48	29.8¾
June	58½	51½	29,8
July	61¾	53½	29,9¾
August	60½	53¾	29,7¼
September	55¼	49¼	29,8¾
October	48	45½	30,0¾
November	36¼	37¼	29,9¼
December	33	31¾	29,9¼
Yearly aver.	46¾	43¼	29,8½

1816.	Monthly average temperature, at 9 o'clock A. M., taking the two extremes.	Monthly average temperature, at 11 P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
January	30½°	30°	29°,4
February	30	32½	29,7
March	36¼	30	29,6¼
April	42	38	29,6¾
May	47½	41½	29,7½
June	57½	48	29,7
July	59	53½	29,5
August	54½	49½	29,8¾
September	52½	47	29,5¼
October	45	43	29,8
November	37½	36½	29,7½
December	31½	31½	29,6¼
Yearly aver.	43¾	40	29,8

1816.	Monthly average temperature, at 9 A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly average pressure, at noonday, adding the columns.
January	33¼°	33¼°	29°,2¼
February	34	33½	29,7¼
March	36½	34¼	29,6¼
April	42¼	38	29,7
May	49¼	44	29,8
June	56¼	49½	29,8¼
July	54¾	52	29,6½
August	57¼	51¾	29,8½
September	52¾	47¼	29,7¼
October	45¾	44	29,7½
November	37¼	36¾	29,6¼
December	32¼	33	29,5¾
Yearly aver.	41¼	41½	29,6¾

TABLES continued.

	Monthly average temperature, at 9 A. M, taking the two extremes.	Monthly average temperature, at 11 P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
1817.			
January	39°	38½°	29°,5
February	40½	41	29,8¼
March	37½	35¼	29,9½
April	46	39½	30,1¾
May	50	44	29,7
June	62½	58	29,6½
July	59	52	29,6½
August	56	49½	29,6
September	50½	49½	29,3¾
October	41	38½	29,6
November	41½	40¼	29,8
December	34	31¼	29,3
Yearly aver.	47	43¼	29,7
1818.			
January	37½°	33½°	29°,6
February	28½	30½	29,4¾
March	39	38	29,3
April	43½	39	29,9½
May	52	49½	29,9
June	63	60	29,8½
July	64	57½	29,9¼
August	60	54	29,8½
September	55½	47½	29,8
October	51½	49	29,7½
November	42½	44	29,6
December	36	39	29,9½
Yearly aver.	48¼	45½	29,8

	Monthly average temperature, at 9 A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly average pressure, at noonday, adding the columns.
1817.			
January	39½°	37¾°	29°,5
February	40½	41½	29,6¾
March	38½	36	29,6
April	47½	42¼	30,2¼
May	49½	42½	29,7½
June	58½	54½	29,7¼
July	58¾	52¾	29,6¼
August	53½	50¾	29,5¾
September	50¾	49¼	29,9
October	42¼	38¼	30,0
November	43½	43¾	29,9¼
December	32¾	33¼	29,4¾
Yearly aver.	46¼	43½	29,7½
1818.			
January	36¼°	34½°	29°,5
February	33	33	29,5¼
March	34½	35¾	29,3¼
April	42	37½	29,8
May	54	48	29,8½
June	62¼	59½	29,9
July	63	52½	29,9¼
August	60	53	30,0
September	54	49¼	29,6¾
October	53	49¼	29,7½
November	46	46	29,7¼
December	37¼	37	29,9½
Yearly aver.	48	44½	29,7½

TABLES continued.

	Monthly average temperature, at 9 o'clock A. M., taking the two extremes.	Monthly average temperature, at 11 P. M., taking the two extremes.	Monthly average pressure, at noonday, taking the two extremes.
1819.	°	°	°
January	36	39½	29,5¾
February	34½	33	29,5
March	43½	41	29,6
April	46½	42½	29,7¼
May	53½	43½	29,8
June	57	50	29,7¼
July	63½	54½	29,8¼
August	65½	57	29,6¼
September	53	51	29,8¼
October	45	44	29,8½
November	36½	33	29,7
December	33	29	29,7¼
Yearly aver.	47¾	43¼	29,7
1820.	°	°	°
January	26	28	30,0
February	39½	39	29,9
March	42½	38½	29,6½
April	49	43	29,9¾
May	55	46½	29,7
June	61	54½	29,8¼
July	63	54	29,7
August	58½	52	29,7
September	53½	49½	29,7
October	42½	42	29,6
November	38½	40	29,9½
December	40½	41¼	29,9½
Yearly aver.	48	44¼	29,8¼

	Monthly average temperature, at 9 A. M., adding the columns.	Monthly average temperature, at 11 P. M., adding the columns.	Monthly average pressure, at noonday, adding the columns.
1819.	°	°	°
January	37	36¼	29,5¼
February	36¼	35¼	29,4¾
March	43	40¼	29,8
April	46¼	41¾	29,7¾
May	52¾	46¼	29,8¾
June	53¾	49¼	29,7¼
July	61¾	55¼	29,9¼
August	63¾	58¼	29,9¾
September	54¼	50¾	29,8¼
October	46¾	43¼	29,7¾
November	34¼	34¼	29,7
December	31¼	30¾	29,6¾
Yearly aver.	46¾	43¾	29,7¼
1820.	°	°	°
January	28¾	29¾	29,8¼
February	37¼	36¾	29,9¼
March	40¾	38	29,8
April	48¼	43	29,8
May	55¾	43½	29,6½
June	59	51	29,8¾
July	62¼	54¾	29,9
August	58¼	53	29,7
September	54	48½	29,8¼
October	45¼	42	29,5¾
November	40¼	39¾	29,8¼
December	37¾	37½	29,9¼
Yearly aver.	47¼	43	29,8¼

TABLES concluded.

Years.	Medium temperature, *per ann.*, at 9 A. M., taking the extremes.	Medium temperature, *per ann.*, at 11 P. M., taking the extremes.	Medium pressure, *per ann.*, at noonday, taking the extremes.	Years.	Medium temperature, *per ann.*, at 9 A. M., adding the columns.	Medium temperature, *per ann.*, at 11 P. M., adding the columns.	Medium pressure, *per ann.*, at noonday, adding the columns.
1809	45°	43½°	29°,9½	1809	47¼°	43¼°	29°,9¾
1810	47	43¼	29,8¾	1810	46½	42¾	29,8¾
1811	48	44¼	29,8½	1811	47¾	44½	29,6½
1812	45½	42¼	29,8¼	1812	45	42¼	29,8½
1813	47	42¾	29,8½	1813	47¼	43¼	29,8½
1814	46	41¾	29,8¾	1814	46½	42¼	29,8¼
1815	48¼	43½	29,8	1815	46¾	43¼	29,8½
1816	43¾	40	29,8	1816	44½	41½	29,6¾
1817	47	43¼	29,7	1817	46¼	43½	29,7½
1818	48¼	45½	29,8	1818	48	44½	29,7½
1819	47¾	43¼	29,7	1819	46¾	43¾	29,7½
1820	48	44¼	29,8¼	1820	47¼	43	29,8½
Average for the 12 years	47¼	42¾	29,8 $\frac{8}{12}$	Average for the 12 years	46 $\frac{10}{12}$	43 $\frac{10}{12}$	29,8½

The lowest fall of the barometer, here, during the twelve years, was on the 5th of March 1818, at noonday;—the thermometer, at that hour, stood at 42°; very high wind;

	Inches.	Lines.
—the barometer at	28	1
The highest rise of the barometer was on the 8th January 1820, ...	31	0
Hence the greatest range of the barometer for the twelve years, ...	2	9

The warmest day during the twelve years was the 12th of June 1818, when the thermometer stood at 84½°. The coldest day during the twelve years was the 18th January 1820, when the thermometer fell, before sunrise, to zero,

and at 10 o'clock A. M. rose to 7°. Hence the greatest range of the thermometer in the shade, here, during the twelve years, was from zero to 84½°.

Table denoting the Course of the Winds, and the Number of Days during which each Wind prevailed.

Years.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
1809	11	52	54	28	6	76	57	81
1810	12	47	56	33	5	65	58	89
1811	18	32	57	31	9	106	35	77
1812	25	57	34	38	7	80	29	96
1813	10	57	14	33	6	102	27	116
1814	7	76	24	33	9	107	30	79
1815	13	31	37	38	9	93	47	97
1816	5	60	46	28	9	67	55	96
1817	11	45	22	40	9	91	51	96
1818	7	35	26	52	9	114	46	76
1819	22	39	24	33	12	89	56	90
1820	17	40	46	23	11	82	59	88
Total number of days	158	571	440	410	101	1072	550	1081

N. B.—NE. means that the wind blew so many days from some one or other of the intermediate points from N to E., and so of the others.

Table shewing the Fall of Snow in Inches.

Years.	Months.	Depth of snow in inches.	Total depth of snow in inches.	In the years	Years.	Months.	Depth of snow in inches.	Total depth of snow in inches.	In the years
1809	Jan.	21½			1815	Jan.	12		
	Feb.	15½				Mar.	1½		
	Dec.	4½	41½	1809		Dec.	14	27½	1815
1810	Jan.	5½			1816	Jan.	7		
	Feb.	3				Feb.	6½		
	Mar.	2¼				Mar.	17		
	Dec.	6	16¾	1810		April	2		
1811	Jan.	1½				Nov.	10		
	Feb.	8				Dec.	18	60½	1816
	April	1½			1817	Jan.	5½		
	Nov.	½				Feb.	4		
	Dec.	2	13½	1811		Mar.	3		
1812	Feb.	4½				Oct.	1		
	Mar.	7				Nov.	3½		
	April	2				Dec.	3	20	1817
	Dec.	½	14	1812	1818	Jan.	15		
1813	Jan.	6				Feb.	5½		
	Feb.	1½				Mar.	8	28½	1818
	Mar.	2			1819	Jan.	1½		
	April	5½				Feb.	1½		
	Nov.	½	15½	1813		Nov.	3½		
1814	Jan.	7				Dec.	10	16½	1819
	Feb.	11½			1820	Jan.	7		
	Mar.	8				Feb.	0½		
	Nov.	1				Mar.	3		
	Dec.	6½	34	1814		Dec.	3	13½	1820

There is no Rain-gauge at Clunie, and the place is not very favourable for one.

General Table of the Weather.

Years.	Number of Fair Days for each Year.	Number of Foul Days for each Year.	Number of Sunshine Days for each Year.
1809	271	94	89
1810	282	83	146
1811	232	133	114
1812	232	134	124
1813	267	98	163
1814	236	129	136
1815	229	136	159
1816	221	145	140
1817	209	156	98
1818	210	155	121
1819	219	146	126
1820	224	142	122
Total	2832	1551	1538
Yearly aver.	236	129¼	128 $\frac{2}{12}$

The Fair days include the Sunshine days; and by the Foul days is meant, that, in every one of them, more or less of rain, hail, or snow, fell.

Table of Phænomena which occurred during the Twelve Years.

Years.	Solar Haloes.	Lunar Haloes.	Parhelions, or Mock Suns.	Waterspouts.	Bright Aurora Borealis.	Thunder-storms.	Earthquakes.	
1809	3	8	—	—	—	—	1	The 9th January, at 6 A. M.
1810	2	5	3	1	—	—	—	
1811	4	9	7	—	—	—	—	Lunar rainbow, 29th August, at 10 P. M.
1812	10	1	11	—	—	—	—	
1813	2	2	2	3	2	—	—	
1814	3	3	—	1	3	—	—	
1815	—	2	—	—	—	—	—	Bright lunar rainbow, 14th December, at 11 P. M.
1816	1	2	—	—	1	—	1	The 13th August, at 11 P. M.
1817	—	2	3	—	2	3	—	
1818	7	5	1	—	1	—	—	
1819	5	2	2	—	7	1	—	
1820	—	1	—		3	—	—	

VII.—*A Description of a New Species of Grimmia, found in Scotland.*

By ROBERT KAYE GREVILLE, Esq. F. R. S. E. M. W. S. &c.

(*Read 12th January 1822.*)

GEN. CHAR. *Seta* terminalis. *Peristomium* simplex ç dentibus 16 integris vel perforatis (rarissime fissis) æquidistantibus. *Calyptra* mitriformis. HOOK. *Musc. Brit.* p. 36.; et *Musc. Exot.* p. 9.

GRIMMIA LEUCOPHÆA.

Grimmia caule breviusculo, subramoso, foliis ovatis, longe piliferis, incanis, nigrescentibus; seta exserta, brevissima, recta; capsula ovata, dentibus brevibus perforatis, operculo obtuso-rostrato. Pl. VI.

HAB. In rupibus prope Edinburgum ad locum *King's Park* dictum.

Planta cæspitosa, incana, saxa sæpe latissime tegens; in ætate valde nigrescens.

CAULES breviusculi, erecti, subsimplices, laxe cæspitosi.

FOLIA laxe imbricata, erecto-patentia, atro-viridia, ovata, concava, nervo ad folii summitatem evanescente; *pili* superne longissimi (folia duplo vel imo triplo longior), inferne breves, aliquando subnulli.

SETA exserta, recta, brevissima.

CAPSULA ovata, rufo-fusca, rarè summitate pilorum foliorum altior, ore annulato.

OPERCULUM brevi-rostratum obtusum.

PERISTOMIUM breve, e dentibus 16 intense rufis perforatis.

CALYPTRA mitriformis, acuminata, inæqualiter fissa.

"Numerous are the species," says DR HOOKER, in his MUSCI EXOTICI, "(if such they may be called), of Grimmia, bordering upon *G. ovata* and *pulvinata*, differing from each other in the various modifications of the leaves, the fruit-stalk, the capsule, and the operculum." The species I have just described must be added to the number of this nearly allied series; but I flatter myself, that, in *G. leucophæa*, there are such striking marks for discrimination, that no confusion can possibly arise in regard to its future identity. It ranks along with those species which have piliferous terminations to the leaves, and an exserted and erect fruit-stalk. They are few in number, even including varieties, and such are not described by BRIDEL or SCHWÆGRICHEN. If we then separate those which have lanceolate and subulate leaves, it will be found that there are only two with which the least confusion is likely to originate: viz. *G. campestris* of BURCHELL, HOOK. *Musc. Exot.* TAB. CXXIX., a native of the Cape of Good Hope, where it grows in dry places on the ground; and *Campylopus lævigatus*

of BRIDEL, *Meth.* p. 76, which was found, in 1806, near Rome, and has since been detected in Switzerland.

Upon an accurate examination, essential differences are perceived; the leaves of *G. campestris* are much broader than those of our plant, and the piliferous terminations much shorter; the teeth of the former are rather long, and are "pretty regularly cleft for nearly half the way down from the apex;" in the latter they are short, never cleft, but perforated, or entire. In Mr BURCHELL's plant, the *seta* is so much exserted, as to convey the base of the capsule considerably above the diaphanous points of the leaves; in ours, the *seta* is so short, that the capsule rarely rises above them, but more commonly the diaphanous points are on a level with the mouth of the capsule.

With regard to *Campylopus lævigatus*, it would not be easy to determine, from BRIDEL's character, its precise relation to our plant, or whether indeed it be the same; in many points they appear to agree; but "*pedunculis subarcuatis*," and "*folia erecta*," render the identity very suspicious, and, if his character be correct, must keep it distinct.

I have received from Mr ARNOTT a plant, which he obtained from the Herbarium of PALISOT DE BEAUVOIS, marked *Grimmia obtusa?* or *G. Doniana?* It is certainly neither species, but accords more nearly with *G. leucophæa*, except in the teeth, which bear a greater resemblance to those of *G. campestris*, and are like them frequently divided almost half way down from the apex; in being rather more branched, and having the seta somewhat longer than in our plant; so that, after all, it may be said to be intermediate between *G. campestris* and *leucophæa*.

Before the capsules arrive at maturity, the leaves of *G. leucophæa* gradually assume a blackish hue; which, contrasted with the hoariness arising from the long silvery

terminations of the leaves, gives an appearance to the plant that belongs not to any other, particularly when viewed covering a large surface of rock.

This species had for some time been mistaken for *G. ovata*, and, without examination, I sent a quantity of it, under that name, to Mr HOBSON of Manchester*, who returned me an answer, denying that it was *G. ovata*, and suspecting it to be *pulvinata*; an attentive examination produced the above result. It has not yet been detected in any other place, which is the more extraordinary, on account of its great abundance in the King's Park.

Explanation of Plate VI.

Fig. 1. 1. Plants, natural size.
2. A plant magnified.
3. One of the upper leaves do.
4. One of the lower leaves do.
5. A capsule do.
6. Operculum do.
7. Three teeth of the peristome do.
8. Calyptra do.

Edinburgh, January 6. 1822.

* The author of "MUSCI BRITANNICI, a collection of British Mosses and Hepaticæ, systematically arranged," &c., a work now going on, and which ought to be in the hands of every muscological student.

VIII.—*On the Geognosy of Germany, with Observations on the Igneous Origin of Trap.*

By Amie Boue', M.D. M.W.S.

In a Letter to Professor Jameson.

(*Read 26th January and 9th February* 1822.)

My dear Sir,

I had long cherished, as you already know, a desire of visiting Germany, that country of true Geology, for the purpose of viewing there the classical points, of retracing the observations already made, and of becoming acquainted with the ideas of the numerous geologists of my native country. That desire has been gratified; and it is with pleasure that I lay before you a short account of the results of my inquiries.

Germany has been visited by so many geologists, and so many parts of that vast empire have been so minutely described, that one might imagine the geologist, in order to acquire a perfect knowledge of the country, had only to

compare it with the description in his hand. This had also been my idea; and, indeed, I have to say, that almost all that I have seen is recorded in the annals of science, or is now known to the German geologists. But I found that all had not been described with sufficient accuracy, nor examined from every possible point of view; and, particularly, that the various deposits had not in all cases been properly classified, from ignorance of the true structure of other countries. So that, if I was not a little surprised to find new facts, or neglected appearances, in localities very often visited by geologists, I was, on the other hand, able to replace some deposits in their true geognostical places; and from this kind of review, I learned more than I could have done in travelling over an unknown country.

An ample detail of the numerous interesting points visited during this long journey shall be sent at another time, my object at present being only to lay before you the principal results of my observations in open field, and in public and private collections, and of a friendly intercourse with many eminent men.

As I have seen in this journey all the principal formations of which the crust of the Earth seems to be composed, I shall communicate my ideas on the series of Formations, dwelling particularly upon those which present the most obscurity or interest, and speaking first of the *stratified* rocks, and afterwards of the *unstratified* ones.

I. Stratified Rocks.

1. *Primitive Rocks.*

The Primitive class seems to contain only two kinds or stratified formations, Gneiss and Mica-slate, of which, even the first predominates in a great degree over the other, (Erzgebirge, Böhmerwaldgebirge, primitive chain

between Austria, Styria, and Hungary, and the primitive country of the centre of France). It is yet possible that there may exist some varieties of primitive clay-slate as subordinate beds; but in the whole of Germany, the Clay-slate, taken for primitive, I pronounce to be Transition, and to pass insensibly into Greywacke, (the Hartz, the Frankenwald, the Erzgebirge, the Carpathians, the Mountains on both sides of the Rhine from Bingen to Bonn, &c.)

2. *Transition Rocks.*

The Clay-slate Formation is improperly so called; for this rock, as in Scotland and England, forms only a very small part, or, in other terms, only subordinate masses, in the extensive deposits of a great variety of rocks, produced by the various mixture of quartz, talc or mica, or chlorite, felspar, and a little calc-spar, or limestone. Such rocks are found, for instance, in the Alps of Savoy, on the banks of the Rhine, in the Erzgebirge, the Carpathians, and in the middle part of Bohemia, where these rocks are extremely interesting, by being composed of distinctly aggregated materials, and by their containing many subordinate beds or masses of various clay-slates impregnated with silica, or, in other words, of varieties of flinty slate and Lydian-stone.

To these oldest transition-rocks, succeeds the Greywacke Formation, as, for example, in the Hartz, the Frankenwald, the chain of hills between Silesia, Bohemia, and Moravia. In these two transition-formations, the limestone forms here and there a series of separate deposits, placed on a line parallel to the general direction of the schistose beds; and when these series are numerous, they seem to be, as in the primitive class of rocks, pretty parallel to each other. Sometimes the limestone concretions are very extensive.

3. *Flœtz Rocks.*

The Flœtz period begins with the Old Red Sandstone, (*Grès rouge*). This sandstone is ordinarily red, generally coarse at first, and afterwards finer: it appears often to be chiefly derived from the disintegration of porphyries, syenites, and granites. In it (as in Silesia), under it (Valley of Tharandt, near Dresden), or upon it (in the Palatinate), occur more or less extensively the coal-sandstones, or coal-measures, having some fresh water shells, and sometimes salt and fresh water organic remains, in different parts of the deposit, but never together in the same bed. In some instances, the sandstone of the coal-formation occupies the greatest part of this formation, as in the Prussian and Bavarian Rhine provinces.

Upon this deposit rests the Zechstein, or Magnesian Limestone, or Calcaire Alpin*; for all these denominations, and the deposits which they indicate, are identical, their various masses and their petrifactions being the same. The *Asche* of the Germans, and their Limestone, with Sparry Iron-ore (Schmalkalden), is the Calcaire Alpin of the south of France, near Figeæ, for instance, a locality described long ago by Cordier (*Journal des Mines*). The Zechstein of the country of Swarzburg, Kamsdorf, Gera, &c. is precisely the Magnesian Limestone, with flustræ, &c. of Sunderland, and also the Calcaire Alpin Magnesien of the south of France. In Germany, the lowest part of this deposit contains ores, which, in France, are found in the uppermost part of the Old Red Sandstone, as

* I do not mean by this term the Limestones of the Alps, which have sometimes been so named without sufficient certainty.

at Chessy. And even in Germany, the Weissliegende, or uppermost part of the Old Red Sandstone, now and then contains these ores, (Eisleben). In England, they are perhaps very feebly indicated in the coal-measures.

On the north side of the Alps, in a part of the Carpathians, and in the Appennines of Tuscany, the Old Red Sandstone, and especially the Coal-formation, is found associated with the First Flœtz Limestone; or, in other words, these two formations alternate with each other. This is very beautifully exemplified in the chain of the Kalenberg, near Vienna. In the Bavarian Rhine provinces, the Zechstein appears also to be represented by beds of Greyish-black Limestone, placed in the Coal-formation, (Obermoschel, &c.)

Your Encrinal Limestone is nothing else than a set of beds of transition-limestone, exactly similar to some of those of the Hartz and the Ardennes. These beds alternate with the undermost part of the Old Red Sandstone, which is in England, as in the Rhine Palatinate, composed in a great measure of coal-sandstones. Indeed this alternation is quite natural, and conformable to the general laws of the succession of formations; which, especially in the floetz series, alternate universally with each other at their point of contact.*

The Variegated Sandstone of the Germans (the Spessart), the Red Ground or Marl, and the *Grès bizarré* of the borders of the Vosges, of Homburg, &c. are one and the same deposit, which is always superior to the First Flœtz Limestone. It seems to me, that it is only in this formation

* For example, the Shell Limestone (Muschelkalkstein), with the uppermost part of the variegated Sandstone, the Chalk with Plastic Clay, the Plastic Clay with the coarse Marine Limestone, &c.

that the great masses of Rock-salt occur, (Chester, Vic, Wiliczka, Comitat of Marmorosh in Hungary, &c.); but salt springs may issue also from some parts of the Old Red Sandstone.

The Second Flœtz Gypsum of the Germans is exactly the same as the Second Gypsum of France, England, and Ireland; the First Gypsum appears wanting in the two last countries.

In Germany, and in the north-eastern and eastern parts of France, we find above the preceding formation, the Shell Limestone (Muschelkalkstein), a very distinct formation of a greyish limestone, having a pretty perfect crystalline texture (Wurtzburg), and sometimes presenting something of an oolitic appearance, (Westphalia, Buckeburg, &c.) The petrifactions which it contains are, more especially terebratulites, pectinites, ammonites, encrinites, and organic remains resembling a kind of isis. In the south-western part of Germany (near Coburg, &c.), and in the Jura chain (Basel), this Limestone becomes a kind of Magnesian Limestone, with siliceous infiltrations, and loses its petrifactions almost entirely. I do not know that there is any deposit corresponding to this in England, although I see it could only be your Lias: but all that I have observed regarding the Lias of England and the northern coast of France, induces me to consider it as the undermost part of the Jura Limestone. Yet it might be that the Shell Limestone (Muschelkalkstein) of the Continent is represented in England by some thin inferior beds of the Lias.

The Jura Limestone of France and Germany corresponds exactly with your Lias, Oolites, Forest Marl, Cornbrash, Limestone, and Clunch Clay. All these various deposits are found in those countries. The Lias abounds in the north of France; the Oolites are found on the northern border of the Hartz, near Hildesheim, and near Goslar;

the Sultmerberg is composed of a very distinct Jura Limetone; the Clunch-clay is very abundant in Westphalia, and in the same part of Germany are found many beds of Marls and Limestones which belong to the Jura. Lastly, the Planerkalk of the north of Bavaria and Swabia, and of many parts of Germany, is nothing else than certain beds of the Jura Limestone, which extend distinctly from Switzerland, through Swabia and Bavaria, as far as Staffelstein and the neighbourhood of Cobourg.

The *Quadersandstein* of the Germans, to which some authors assign a place above the Jura Limestone, I still think occurs under it, and therefore immediately above the Variegated Sandstone.

The Green-sand, the Planerkalk of WERNER, abounds in the northern parts of France; it is found in Westphalia (from Unna as far as Soist, on the borders of the Hartz, near Goslar and Ilsenberg), near Dresden *, in Poland, and nearly all the Planerkalk of the basin of Bohemia belongs to the same formation. It never contains belemnites, seldom terebratulites, and here and there a kind of massive hornstone. In Moravia, France, and Bavaria, it contains a deposit of hydrate of iron. This deposit is everywhere identical with that of England; and near the Hartz, lies upon the Quadersandstein, and under the Coarse Chalk.

The chalk so profusely distributed in England and France, is also pretty frequent in the north and middle of Germany, especially the inferior part or coarse chalk, which has there been often called *Plänerkalk*. It occupies a great part of a sort of vast sinuosity, stretching from

* The Green-sand of Dresden and the neighbourhood of Meissen contains three or four species of Terebratulites, without striæ, one or two with striæ, echinites, pectinites, bivalves, and teeth of a squalus.

Saltzkotten, near Paderborn, to Bielefeld and Hilter; and extends behind Paderborn as far as the neighbourhood of Herrenhausen and Kreutzkrieg. There it forms, in the undermost part, a true greyish limestone, with nodules of black flint; and, in the uppermost part, it is a whitish marly limestone, with many echinites, belemnites, mytilites, &c. It just re-appears near Hanover and Luneburg, but forms, farther east, pretty extensive hillocks and plains along the Hartz, from Unter-Elbe as far as Quedlinburg. At this last place, the coarse chalk passes insensibly into the true chalk with flint, having belemnites, echinites, terebratulites, &c. in abundance.

The chalk extends also into Moravia, and forms, particularly near Tribau and Lissitz, a pretty extensive range of hills, in which petrifactions are in some places abundant, in others very scarce. Near Blansko, the last point which this deposit has reached, it contains shells resembling ammonites? or argonautes? and small bivalves; and here it covers a coarse sandstone, under which is situated, first, a siliceous rock, containing flint-nodules, echinites, and small bivalves, and, undermost, a white sand (Quadersandstein), with rich deposits of cellular and pisiform brown ironstone (hydrate of iron). This last deposit is only found in three places,—at Olomuczan, and Kuditz, near Blansko, where it lies in hollows of transition-limestone, and at Salhanka, upon gneiss.

To complete the enumeration of localities where chalk is found in Germany, I have still to mention the Isles of Zealand, Möen, Wöllin, and Rugen, and the Lake of Ücker. In many other points of the eastern part of Prussia, it seems to be indicated, or to be but slightly covered, by the following formations, and in Poland it is very widely distributed.

Upon the chalk, the Plastic Clay, or *Argile plastique*, is widely distributed in Germany, especially in the northern parts. Indeed, the greatest portion of that immense track of alluvial country (improperly so called), from the Rhine to Königsberg, belongs to it. It seems only that the coarse marine limestone and first fresh-water formation are almost entirely wanting, and that this clay and these sands are covered by the upper marine sandy deposit of Paris, to which would belong, perhaps, also the granite-blocks, &c. The same will be the case with the great arenaceous deposit of the Bavarian flat country, of the neighbourhood of Vienna, and of the bottom of the immense Hungarian basin: but in these two last localities, the coarse marine limestone is of pretty frequent occurrence.

In the north of Germany, the plastic clay often contains petrifactions; as in the Magdeberg, near Halle; in Lusatia, &c. The brown coal, which occasionally contains earthy gypsum, as at Halle, and, in other places, amber, always fresh-water shells, also coleopterous and fresh-water insects, occurs in considerable abundance in the plastic clay in the north of Bohemia and Thuringia; and from the Rhine to Königsberg, geologists have observed, especially in the basins of existing rivers, a series of these deposits; for instance, near Köln, in the valley of the Weser, in Thuringia, below the town of Berlin, and farther to the north-east. In Slavonia, it contains great masses of sulphur; and in Hungary, and at Vienna, small pieces of realgar. The very compact sandstone which this formation sometimes contains, and which often abounds in fragments of flint, is, for example, very well marked near Zeitz, Beuchlitz, Blansko, Carlsbad, and Töplitz, where it contains the quartz-crystals which had once formed a part of the flœtz porphyries of the neighbourhood.

All the pseudo-volcanic products of the Mittelgebirge are owing to the brown coal of this formation.

The Coarse Marine Limestone (Calcaire grossier) occurs very rarely, and in very small patches, in the north of Germany; as, for instance, near Lemgo, in Westphalia, where it contains cucullea, turritella, natica or ampullaria, nucleola, and other bivalves *. I have also seen it with the same shells near Cassel, Dransfeld, Ahlfeld, and Hildesheim.

The First Fresh-water Formation does not occur in Germany, Austria, and Hungary, yet we have seen gypsum in their plastic clays; on the other hand, the coarse Marine Limestone, or, at least, what I take for it, contains, in Austria and Hungary, remains of amphibious, and even of terrestrial animals. Regarding this interesting fact, however, I cannot say more at present.

The Upper Marine Formation abounds in Austria and Hungary, as well as in the north of Germany; but in the two first countries it is often calcareous, and is associated with much clay, and marl, containing a numerous set of petrifactions, many of which are like those described by Brocchi in the Subappennine Hills.

The Upper Fresh-water Formation exists in the basin of Vienna, (Baden, &c.), in Hungary, and in Moravia. In Hungary, near Pest, there is a true fresh-water limestone, with planorbes and lymnei; and in Moravia, near Nicolchitz, it forms, in a valley, a small deposit, like that of Œningen; and the schistose marls contain there only some impressions of aquatic plants and of insects, (Dipteres). A kind of semi-opal also occurs there.

The north of Germany abounds in Calcareous Tuffs.

* The Nagelfluh of Switzerland belongs probably to various epochas of the Paris formation.

II. Unstratified Rocks.

The Unstratified Rocks, which appeared, among the preceding, as subordinate masses, or immense local deposits, have arrested my attention during this journey; and I believe we are yet very far from knowing, either their origin, or their true geognostic position.

Granite appears to me to exist in the primitive class of rocks, in great hills or domes, and in veins; of the latter of which, some are in connection with those great bodies of granite constituting mountains; others are isolated in the gneiss or mica-slate, in the same manner as the basaltic veins or dikes are in chalk and other rocks. In the great track of primitive schistose rocks of the Scandinavian peninsula, the granite is confined to the gneiss and mica-slate.

In clay-slate rocks, the granites often occur under the form of syenite, and even of syenitic porphyry, their position being the same as that of the granites in gneiss and mica-slate. I have only to observe, that the various syenitic porphyries are pretty frequent in veins or dikes. To these granites belong some syenites in the clay-slate formation between the northern part of Transylvania and Hungaria, perhaps the syenite near Schemnitz, the granites of the Frankenwald, of the Cotentin, and probably many granites of Cornwall and Brittany.

Those granites, which are undoubtedly newer than greywacke, are almost entirely syenites, or syenitic; at least, it seems probable that these rocks are newer than the granites which we find in the clay-slate districts. One of the best examples of this class of syenites and granites is seen in those which cover so great an extent of country from Meissen to Lauban, and which are now

known to repose upon greywacke, and to be covered by it, —or, if this be denied, which are situated in greywacke. The granites of the Hartz, of the Thuringerwald, of Westmorland, of the Criffel, the granite near Loch Ken, &c. must be arranged here.

A peculiarity which these granitic masses have, is to be often surrounded, in part, or in whole, with peculiar anomalous rocks called Hornfels in the Hartz, and varieties of gneiss in Scotland. These last rocks are intermixed with the true greywacke, and pass into it.

To these crystalline rocks succeed great deposits of porphyry. These porphyries, in some countries, form a kind of series of alternating masses with the greywacke, as in Cumberland, and in the Fichtelgebirge, where the Felspathic Breccias or Tuffs are particularly very remarkable. In other countries, the porphyries seem to have appeared later, or not to have had that facility of alternating with other rocks; and hence they rise in the form of immense massive hills, as in Schemnitz, Kremnitz, and in many parts of Transylvania, of the north of Germany, and of the middle of France.

In many countries, the porphyries occur in great masses, veins, or even in beds, in the old red sandstone (Silesia). But their appearance in the middle of the coal formation is the most interesting, because in that case we have been enabled to trace their origin. Near Halle, for instance, where such an occurrence takes place, the porphyries appear in beautiful domes, like the Puy de Sarcouy, in Auvergne, which pass through or under the coal-formation, while another portion evidently extends itself above the arenaceous deposit.

It is also curious to observe, in the neighbourhood of these porphyries, the great disturbances of the strata, the alteration of the coal, and the great bodies of singular anoma-

lous rocks, which, notwithstanding that they pass into sandstones, have so little of their appearance, that they receive other names, Claystone Tuff, Lydian-stone, Jasper, &c.; and indeed their varieties are so numerous, that there is no nomenclature large enough for them.

These porphyries of the red sandstone and coal formation are associated with many trap-rocks, which are distinctly pyroxenic or basaltic, although the trap-rocks which accompany the crystalline deposits in the greywacke appear sometimes to be much more difficultly recognised as such. Yet, near Prague, I have seen in transition-slate, beds or masses of well-marked dolerite, having the common igneous accidents in their upper and under part. The same appearance I had also the pleasure of observing in the valley of Triebisch, near Freyberg, in transition clay-slate.

The trap-rocks form in the Floetz Period, as in the Transition, more commonly veins, with, or without, small *coulees*, or a kind of beds, than hills. The *accidents* of the neighbouring rocks are various. I shall only mention here, that, at Planitz, I observed sandstone-slate, or slate-clay, much indurated under the amygdaloid, and besides the amygdaloid contained an immense quantity of pieces of the old red sandstone, so that the whole had pretty nearly the appearance of an extent of mica-slate, with granitic veins, like those of Garviemore. Besides, I have observed there, that a part of the amygdaloid was only an altered sandstone; and, for this reason, many of the amygdaloids do not give pyroxene by the analysis. How such a change can be produced, I do not know; but such is the fact, and every body may see it. I am only astonished that it has not been recorded. Indeed, I can assert, that the Erzgebirge contains many interesting facts, and distinct

appearances, which might be adduced in support of the Huttonian theory. Were I not apprehensive of being considered rash, I would mention the appearance of porphyry elevating itself, with various true igneous *accidents*, from below, and out of the claystone and gneiss rocks. It is also ascertained, I can say, that the beds of porphyry described in the gneiss of that country, are true veins, belonging, as would appear, nearly all to the beginning of the Floetz Period; in which there yet appears, as in Zinnwald, a granite, with ores of zinc, and other minerals, which have been erroneously named the very oldest ones. That the metalliferous veins are intimately united with the appearances of these crystalline igneous rocks, I cannot doubt; but, as may naturally be supposed, some of the minerals contained in the veins have got there from above, or have been formed in the aqueous way. The great metalliferous deposits in veins appeared to me to form a kind of net-work. Certainly nearly all that WERNER has said about them is true: but his explanation, by filling up entirely from above, is no longer admissible. When we consider such vast bodies of rock impregnated with ores, as the auriferous transition-porphyries of Kremnitz and of Transylvania; and when we reflect that all the rich mines of Hungaria and Transylvania are in porphyry masses, excepting a single one in greywacke (Verespatak); and when we entertain a strong suspicion that these are igneous products, we will not long be puzzled to comprehend the phenomena. You will probably oppose to the igneous hypothesis the Mercury-mines in the coal-formation; but these also seem to have been produced in the same way, as results from observations I lately made in the Bavarian Rhine provinces. The ores are there contained in small veins in porphyry, or in rocks in contact with such products; and

these coaly or arenaceous rocks are almost always indurated or altered in a thousand various ways; but I shall discuss this subject at another time.

In the period subsequent to the Old Red Sandstone, the Basalts have protruded from below, probably at various irregular periods, even before the formation of chalk; for the cones, hills, and veins of basalts, so well known around the Meissner, Eisenach, the Rhonegebirge, and Göttingen, seem to indicate such an age. But this is a point that requires very minute investigation.

Germany possesses a great variety of basaltic deposits, most of which are analogous to those of Ireland, and to the most of those in Scotland. I say most of those in Scotland, because I am now inclined to classify the few hills around Edinburgh, Arthur's Seat, Salisbury-craigs, and such like deposits, with those of Eissenach. These are certainly in Germany the oldest, and they comprehend some conical hills and veins in different parts.

The other basalts in Germany can be divided into those which have been formed under water, like the preceding, and those which have flown in the open air. The first, like the basalts in Ireland and Scotland, posterior to the chalk formation, form conical or massive hills, a kind of platforms, or high plains very little inclined, and veins or dikes. The cones or hills are principally formed of various porphyritic clinkstones, which take, as in the Mittelgebirge and Rhongebirge, the place of the trachyte of other great deposits. The group of Mezen, in Auvergne, presents the same fact, although it was probably formed above the water. The plateaux, or nappes, present the same variety of basalt and tuffs as Ireland and Scotland, and some points in Auvergne, and also the same calcareous and zeolitic substances.

Basaltic veins are very frequent in Germany, and are found in almost all the formations of that country, with all the *accidents*, as in Scotland. The Quadersandstein of the north of Bohemia, and the Shell Limestone (Muschelkalkstein) of the western part of Germany, present beautiful examples of these appearances.

The second less numerous class of igneous rocks which appear to have flown in the open air, occur not only in hills with craters, and with scoriæ, but also in currents. In the south of Germany, in Hungary, and Transylvania, this class is exceedingly well exemplified; for there the trachytes form great and high districts, more or less surrounded by or associated with basalts; for example, near Feldbach, in Styria. In Hungary and Transylvania, they are accompanied also with vitreous rocks, pumice, and great masses of re-agglutinated trachytic, or pumice-rocks, which show, by sometimes containing shells of the Parisian formation, the recent age of these deposits. Such is particularly the nature of these formations in Hungary, where they rest at Chemnitz and Cremnitz upon the transition metalliferous porphyries, and form, as it were, four or five great islands in the middle of that immense basin.

In the other parts of Germany there exist no trachytes, but only basaltic lavas, with scoriæ and craters, or indications of them. Thus there is a very beautiful crater near the Pferde Kopf, in the Rhongebirge; distinct lava-streams are observed in the Vogelsgebirge; at Eger, there are true volcanic scoriæ, and indications of a crater; near Hof, upon the borders of Moravia and Silesia, the Raudenberg is a great heap of red scoriæ, like the Puy de Graveneire, in Auvergne, or in Vivarais; and there is a portion of a crater and small streams of basaltic lava; lastly, even in the Riesengebirge, there is a crater and streams of lava.

I shall now conclude this long letter, by enumerating the characters which appear to me most distinctive of the two kinds of igneous rocks, those formed under, and those formed above the water.

1. The igneous rocks formed under water, at least those posterior to the chalk formation, do not rise into hills of so great a height as those formed above the surface; and, in general, the first class of rocks must have certainly, in all periods, had more difficulty in attaining the same height as the second.

2. The first class produce veins or dikes more easily, and in greater number, than the second.

3. When the first class of rokcs form a kind of coulee or stream, these streams seem generally not to unite the length and the small breadth of the streams (coulees) above the water.

4. The rocks of the first class are generally more compact than those of the second.

5 The basalts of the first class are often intimately united with basaltic tuffs, and the porphyries with some kinds of felspathic breccia; an appearance which is almost entirely unknown in the basalts produced above the surface of the water, because in them the small pieces which form the tuffs had been ejected by the volcanoes under the form of rapilli.

6. Rocks with the vitreous character abound much more in the igneous rocks formed above water, than in those formed under it.

7. The igneous rocks formed under water, contain many substances, produced by infiltration, unknown in the other class of rocks, and more frequently also substances produced by sublimation.

8. The basalts formed under water show imbedded, very often, pieces of the neighbouring rock, which are more or

less indurated or altered. Beautiful examples of this I observed in the basaltic cone of Dosenberg, near Warburg, where the rock is full of pieces of the Shell Limestone (Muschelkalkstein); and in the small clinkstone-cone near Banow, upon the borders of Hungary and Moravia, the rock contains great and small masses of clay and sandstone, so much indurated and altered, that they are like the rock of Portrush in Ireland.

9. The neighbouring rocks are rarely altered near the lavas: on the other hand, near the basalts formed under water, these same rocks are very often subjected to various indurations, alterations, and penetrations of igneous gaseous matters.

I am, my dear Sir, &c.

IX.—*A New Arrangement of the Genera of Mosses, with Characters, and Observations on their Distribution, History, and Structure.*

By R. K. Greville, Esq. F.R.S.E. M.W.S. &c.,

and

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(*Read 23d February* 1822.)

Memoir I.

Before we proceed to the definition of the Order, we shall offer some preliminary observations on the principal parts, of which we avail ourselves in the construction of generic characters, and the formation of natural groups.

It is well known, that the great distinguishing character between acotyledonous or exembryonate plants, and all other vegetable tribes, is, as the name imports, the absence of any cotyledon in the embryo, or, more properly, the entire absence of the embryo itself. In all cotyledonous plants, stamens and pistils are invariably present: on the contrary, in the acotyledonous orders, they are to all ap-

pearance totally absent; and botanists, unwilling that such a want of uniformity should exist in the vegetable world, have spared no labour, and taxed their ingenuity, to discover, in the more imperfect tribes, something at least analogous to such organs. According to the opinions, however, of later physiologists, and in which we heartily concur, it is extremely improbable that acotyledonous plants are furnished with stamens and pistils, and that through their agency the seeds or reproductive sporules are formed.

This idea is corroborated by the common phenomenon which takes place in those cotyledonous plants which rarely bring their seeds to maturity; small bulbs (*gemmæ*), analogous to the sporulæ of the Cryptogamia, are produced in the axillæ of the leaves, which, when they fall off, strike root at any part indiscriminately; thus differing most essentially from true seeds, while the new plant which arises from them is equally perfect. This appears also to have been nearly the opinion that DILLENIUS * entertained respecting the propagation of the Musci, and it has been confirmed in later times by the celebrated RICHARD, and others.

What the organs really are, in the plants under review, which the accurate HEDWIG so well figured and described under the name of stamens, we leave to others to decide; but we cannot help entering our protest against those bodies called Stamina and Pistilla (the young theca) being regarded in a similar light with the same organs in more perfect plants. "Though," says SPRENGEL,† "I have formerly been a zealous advocate for HEDWIG's theory of the Fructification of Mosses, it has nevertheless appeared

* DILL. Hist. Musc. p. 229.

† Int. to Crypt. Plants, Letter xvii. p. 260. of the English edition.

to me an insurmountable objection, that the supposed anthers can again produce buds and strike roots; which is certainly the case with regard to the disks of *Polytrichum commune*, *Bartrama fontana*, *Bryum palustre*, *undulatum*, *cuspidatum*, *punctatum*, and with those of *Tortula ruralis*. In *Bryum argenteum* we see the buds containing the supposed anthers constantly drop off, strike root, and produce new plants: this I have observed myself times out of number. Still more in point is the experiment first made by DAVID MEESE, of sowing the stellulæ of *Polytrichum commune*, containing merely club-shaped bodies; when he found that plants came up, which in their turn produced fruit. Another excellent naturalist, Dr ROTH, has made similar observations with regard to *Hypnum squarrosum* and *Bryum argenteum*." He afterwards adds, "It is more probable, therefore, that these supposed anthers are mere gemmæ, produced by the superabundance of the juices, and hence surrounded by succulent filaments *."

PALISOT DE BEAUVOIS differed from HEDWIG; he affirmed that the theca contained the pollen, and that the columella (his theca) enclosed the sporules †, which were fecundated by the pollen by means of the ciliæ, as they escaped through the orifice at the summit ‡. This opinion our justly celebrated countryman Mr BROWN found no difficulty in refuting, by showing, that what PALISOT supposed to be pollen, was nothing more than a part of the sporulæ, which had been carried into the interior of the columella by the dissecting instrument ||.

* Int. to Crypt. Plants, p. 262, of Engl. edit.

† Prodrome des cinquième et sixième familles de l'Æthéogamie, p. 4.

‡ Same work, p. 10.

|| Linn. Trans. vol. x. p. 314.

In thus supporting what seems to have been suggested by DILLENIUS, and confirmed by RICHARD, &c., we do not stand singly, having on our side one of the most acute muscologists of which the world can boast. "The more intimately we become acquainted," says Dr HOOKER *, "with the reproductive organs of the acotyledonous or cryptogamic plants, the more apparent is it, in my opinion, that there are no sexes, as in the phænogamous plants, no stamens, and no pistil, nor any thing analogous to them; consequently no true seed, which can only be produced through their co-operation. The structure of the seeds themselves (more properly sporules) tends greatly to confirm such an opinion; there being, in reality, no distinction into cotyledon radicle or plumule; in short, no embryo, any more than there is in the little bulbs seen upon the stalks of the *Onion* tribe, and upon *Polygonum viviparum*, &c., which yet equally produce perfect plants."

That part of Mosses which contains the sporulæ, has been by some termed *capsula*, or capsule; others have adopted the name *theca*, which, on account of the structure differing materially from the capsule of cotyledonous plants, and also somewhat from the similar organ in other acotyledonous orders, we prefer to capsule, being, at the same time, less liable to ambiguity; a circumstance very desirable in the present period, when the great divisions of the natural system are daily becoming better understood, and a peculiar nomenclature for the abstruser departments more and more necessary.

The theca is always unilocular, contrary to the opinion of PALISOT DE BEAUVOIS, who separates *Pogonatum* and *Polytrichum*, on account of the simple and multilocular

* Flora Scotica, Pt. 2. p. 1. note.

theca; mistaking the plicæ, or folds, of the columella, found more or less in all the *Polytrichoideæ*, for actual dissepiments. It is also, except in the genera *Andræa*, *Phascum* and *Voitia*, furnished with a deciduous lid or operculum, and the sporulæ are evacuated by the open apex; at its base is sometimes a carnose body, termed an *apophysis*, having externally the appearance of being a continuation of the theca, and liable to be confounded with it; but within, is well marked by the total absence of sporulæ, and by its containing a pulpy mass similar to that which at an early period fills up the cavity of the columella, and surrounds the sporular bag. The theca is generally supported by a fruit-stalk, called a *seta* (*pedunculus*, or *pedicellus*, of some authors), which varies in length from almost a total absence to above three inches, and in structure resembles the theca. The only exception to this fact is found in the genera *Andræa* and *Sphagnum;* the former is, with its small apophysis, sessile on an elongated receptacle; and the latter also, entirely sessile on a highly curious receptacle, resembling a thin section of a cylinder placed transversely upon a peduncle of nearly the same nature as the receptacle itself, and altogether different from a true seta, although like to it in form. The base of the true or apparent seta, it is worthy of remark, is generally furnished with leaves of a different kind from those of the stem and branches; they have received the name of *Perichætial* leaves, and at one time entirely surround the receptacle, seta, theca, and calyptra. The presence or absence of these leaves, has been considered by some authors, as PALISOT DE BEAUVOIS, as worthy to assist in the construction of genera: thus, *Pogonatum* would differ from *Polytrichum*, *Cecalyphum* from *Dicranum*, &c. to which we cannot assent; for, on this principle, *Andræa nivalis* might even be separated from the others. It may, how-

ever, be employed with effect, in the framing of specific characters.

Within the theca, and attached to its sides and base by a cellular pulp intermingled with very slender filaments, is placed a membrane, which forms a complete lining: proceeding from the stoma, or mouth, downwards, it is continued to the base, when it is reflected upwards, forming a central column, till on a level with the mouth of the theca. This part has been generally denominated a Columella, and is very different from the placenta * in cotyledonous plants, to which it has been sometimes compared †. A bag is thus formed between the columella and that part of the same organ which lines the theca, in which the sporulæ are situated. The whole is closed by a very subtile membranous expansion, stretching between the summit of the lining and the columella, which (although in *Gymnostomum* it is often of a stronger texture), by the maturing of the theca, and separation of the operculum, lacerates, and, in most instances, becomes evanescent ‡. On the open apex of the columella is fixed another membrane, more or less of a

* Brown in Linn. Trans. vol. x. p. 315.

† Those who, in consequence of a fancied analogy, wish to apply to the Mosses the terms used among the Embryonatæ, or phænogamous plants, might, in the language of carpologists, designate the three principal parts of the theca by Epicarp, Sarcocarp, and Endocarp. The sarcocarp almost always dries up, except where it forms the interior of an apophysis, and is then more permanent. It is the endocarp which is turned upwards into the columella; and this affords an additional argument against the columella being regarded in the light of a *placenta* or *trophosperm*.

‡ In Dr Hooker's excellent figure of *Gymnostomum Xanthocarpum* in the Musci Exotici, the membrane which closes the sporular bag is admirably delineated, Tab. 153. fig. 9.—It ought to be observed, that Palisot has described this membrance in the Mosses without a peristome, but denied it to the others.

conical form, and of a somewhat different texture and colour, which, by age, often shrinks to the appearance of a mere lid to its orifice. Sometimes it is more rigid (as in *Splachnum*, *Tayloria*, and *Gymnostomum Donianum*), and is then not unfrequently called an exserted columella. It also, in some instances, adheres closely to the summit of the interior of the operculum (as in *Gymnostomum Hiemii*, and *Hypnum dendroides*), which it raises or depresses, according to the degree of dryness or humidity to which it is exposed. It is this part which we conceive to be the stigma of Palisot de Beauvois, but which we propose to designate by the more appropriate name of *Opercular Membrane*.

We have not been able to trace this conical membrane in the *Polytricha*, unless what Mr Brown * mentions as the pulpy continuation of the columella within the operculum be considered as such: but, as he afterwards † remarks, the uniform texture, and exact form of the tympanum or epiphragma, closing the mouth of the theca, remain to be accounted for. To us this epiphragma appears to be very different from, but to supply the place of, the opercular membrane; it adheres, when young, to the summit of the columella, and entirely closes the stoma; then passing to the base of each tooth, is reflected so as to line it to the very apex, thus forming a real membranaceous inner peristome; and,— a structure easily seen, if the epiphragma, of probably any species of the genus, be carefully removed, and placed under the microscope,—the margin will be found to be beautifully split into segments, or ciliæ, equal in number to the teeth. This we cannot but consider, as we have already

* Linn. Trans. vol. x. p. 318. † Ibid. vol. xii. p. 567.

said, to be a true inner peristome, and the epiphragma or tympanum only an expansion of the membrane, which (as in *Hypnum*) connects the bases of the inner teeth. Very different, indeed, is the structure which Mr James Sowerby first noticed, in *P. subrotundum*, and of which a dissection is given in English Botany, Tab. 1624., as also under the species *alpinum* and *undulatum*. This structure, which has been also observed by Mr Brown in *P. urnigerum*, and a Nepal species of his own, *P. microstomum*, is described by Sir James Edward Smith as an inner peristome; whereas it is nothing more than the transverse membrane which arises from the inner wall, or the lining of the theca, and is connected with the summit of the columella. The true inner membranaceous peristome is remarkably evident in ripe capsules of *P. alpinum*.

The membrane to which we have already alluded, as closing the mouth of the sporular bag, there is every reason to suppose, is stronger and more durable in all such as have a naked peristome. Whatever service it may perform in them, the membranaceous expansion of the inner peristome may assist to perform in *Polytrichum*, for the teeth of that genus afford but little protection to the mouth after the operculum has fallen: and although the membrane which closes the sporular bag also exists, something more may be necessary to effect a complete dispersion of the sporulæ, which are obliged to escape by the orifices left between the teeth, by the elevation of the tympanum.

It was not until after a very careful examination that we could determine whether the columella of *Calymperes* was furnished with the conical or opercular membrane. The horizontal epiphragma stretching across the stoma, which, in a young state, much resembles that of *Polytrichum*, induced us to think it could not be present; while, on the other hand, the epiphragma ultimately splitting into teeth,

and the depression of the columella without showing any marks of having been attached to the epiphragma, inclined us to the contrary opinion, which, upon farther investigation, proved to be correct. This membrane (*stigma* of Palisot de Beauvois) is also very difficult to be seen, though always present in *Funaria*. Whence that author's remark, " stigma simple, et non apparent dans la *Stréphédie* (*Funaria*)."

It is worthy of remark, that in one species of *Calymperes*, which Mr Brown examined, he mentions the membrane as " entirely wanting, or firmly adhering to the inner surface of the operculum, along with which a considerable portion of the columella also separates *;" which considerably favours our idea of the columella being furnished with an opercular membrane, which in this case might have penetrated the centre of the epiphragma, and produced the above mentioned adhesion.

Mr Brown † seems to imagine that the spongy epiphragma of *Calymperes* is analogous to the horizontal membrane which arises from the lining of the theca in many *Gymnostoma*, *Weissia Templetoni*, &c.; thus making it merely close up the mouth of the sporular bag. We regret, however, that our specimens of *Calymperes lonchophyllum* and *C. Palisoti* are not in a proper state for examination; but we can bear witness to the accuracy of that part of Dr Hooker's figure of *C. Gardneri* ‡, in which the membrane is represented as arising from the outer wall of the theca, which is really the case, and must therefore be considered as a true and curiously modified peristomium, bearing no very distant similitude to *Leptostomum*, in one species of

* Linn. Trans. vol. xii. p. 573, note. † Ibid.

‡ Musc. Exot. Tab. 146.

which (*L. erectum* of BROWN), Dr HOOKER figures and describes the membranaceous peristomium as bearing traces of imperfect teeth *.

The gradual splitting, in *Calymperes*, of the membrane into the teeth, which are never erect, is admirably calculated to render the dispersion of the sporules more perfect.

We suspect that the lining to the theca, the columella, and perhaps also its terminating membrane, will never be found wanting in any moss, if it be examined at the period most favourable to their development, which must necessarily take place at different ages in different species, but especially in different genera. There are, however, some instances in which the reverse has been maintained. *Andræa* has been denied a lining to the theca †. *Phascum serratum*, and some others, are generally declared to have no columella, while there is an evident one in *Ph. rectum* and *Ph. curvicollum*. In regard to *Andræa*, we believe that the lining is present before the theca bursts into its four valves: an operation extremely liable to render a delicate membrane evanescent. With regard to the *Phasca*, the minuteness of the theca in a young state is such, as to render the dissection very difficult: we therefore confess, that we have not by actual observation been able to establish our opinions in this instance; but have little doubt, however, that a columella is truly present; and we conceive that, at an early period, the membrane, which connects it to the lining of the theca, gives way, thus allowing it to shrink to the base of the theca, and from its minuteness to become inconspicuous. The whole genus *Sphagnum* has more than once deceived us by the apparent total absence of this part, and it was not until we had repeatedly examined the theca, before it

* Musc. Exot. Tab. 169.

† HOOKER in Linn. Trans. vol. x.

had emerged from the perichætial leaves, that we clearly ascertained it to possess one occupying a large proportion of the theca, and bearing on its summit the opercular mem brane. The appearance it generally assumes in maturity is that of a convex membrane lying across the bottom of the theca, suggesting the idea, that a lining to the base had separated from its attachment, and had been somewhat elevated without laceration.

We have dwelt perhaps rather longer on the columella than we ourselves originally intended. Our excuse must be, that we really consider it to be an important organ, the economy of which is at present involved in obscurity; and we cannot regard it in the same point of view as Mr Brown and Dr Hooker seem to do, however unwilling we may be to differ from two of the most learned authorities of the present day.

Dr Hooker * conceives the columella to be "nothing more than the remains of the cellular and pulpy substance in which the seeds have not been perfected, and which, as we may consequently expect, shrinks up into an angular axis or columella." In this passage, as in the following, we conceive the columella to be spoken of generally.

"In some cases," says Mr Brown †, "the seeds may be formed in a much greater portion of the columella than in others; and it is even not improbable that, in certain cases, its whole substance may be converted into seeds; or, to speak more accurately, that it may produce seeds even to the centre, and that the cells in which they were probably formed may be reabsorbed."

The late Professor Richard was also of the same opi-

* Flora Londinensis, New Series, under *Diphyscium foliosum.*

† Linn. Trans. vol. x. p. 312.

nion: "Toute pyxidule (*theca* nobis) est d'abord complétement solide et charnue; mais lorsqu'elle a pris un certain accroissement, sa substance interne se grenèlle finement, se distingue peu à peu du test, et passe enfin à l'état d'une très fine poussière. Assez souvent une portion centrale de cette substance persiste sous la forme d'un axe longitudinal, qu'on appelle *columelle* *."

We do not by any means intend to assert that the sporulæ are not in some cases formed in much greater abundance than in others: this we know to be true. The cellular matter, in which the sporulæ are produced, if any remains, will also shrink, and perhaps adhere to the columella, particularly if the sporules are first formed in that portion of the granular mass nearest the lining of the theca. In many cases, the columella has assuredly little appearance of a regularly formed body, and in some it is scarcely possible to discover it at all; yet when we see the same part constantly exhibiting a beautiful and symmetrical structure in other species, it is surely fair to draw the general inference, that it is not formed by the contraction of the mere debris of the cellulose or pulpy nidus of the sporules; witness the columella of *Gymnostomum Xanthocarpum*, of *G. pyriforme*, and *G. involutum*; the columella of *Dawsonia*, of *Lyellia*, of all the *Polytricha*; of *Tayloria*, *Systylium*, and all the *Splachna*.

The columella is also, in very many instances, evidently tubular, which could not be the result of contraction, but rather a proof of the contrary, at least in the sense of the above named learned Bryologists. We may here, however, repeat what we have stated, when mentioning the apophysis, to be our opinion, that, at an early period, the cavity of

* BULLIARD's Dict. Element. de Botanique, edited by RICHARD, p. 67.

the apophysis, columella, and opercular membrane, as well as the interval between the lining and the theca, is always filled up with a pulpy matter. This is beautifully illustrated in *Buxbaumia*, and is what Mr Brown and Mr Turner have observed in *Polytrichum* *. This, however, which is quite different from the sporular granular substance, rapidly dries up in some mosses; producing, among other appearances, the curious effect which the apophysis has, in the mature capsules of *Splachnum rubrum* and *S. luteum*. In most instances, however, it is more durable in the apophysis, and is also sometimes permanent in the columella, as in *Polytrichum*, and has then been improperly compared to the placention of seeds in phænogamous or cotyledonous plants.

Although we have noticed the distinction between the columella and the opercular membrane, to which it is frequently so united as to appear a single body,—and consider the former in the light of a modified continuation of the lining of the theca, we shall, to avoid confusion, still continue to call it a columella, and to use the terms of *absent*, *elongated*, or *exserted*, according as it appears in the mature theca to have subsided, or, taken in conjunction with its opercular membrane, to have remained of undiminished length.

The *stoma* or mouth of the theca is either naked, as in *Gymnostomum* and *Hedwigia*; or, generally, furnished with a series of ciliæ, called teeth (*dentes*); which may be either in a single series, as in *Splachnum*, *Grimmia*, and *Dicranum*; or in a compound or double series, as in *Hookeria*, *Hypnum*, and *Bryum*. In all mosses which possess a peristomium, it arises from the surface of the

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* Brown in Linn. Trans. vol. x. p. 318.

stoma, or springs from it, within the margin, and a little below the summit of the theca. In the latter case, the teeth are generally more or less connected by a membrane, which not unfrequently arises to a level with the stoma, or even above it. Sometimes all vestiges of the teeth then disappear, thus presenting the aspect of a truly membranaceous peristome, as is seen in *Diphysium*, *Buxbaumia*, and *Leptostomum*; and in such as have a double peristome of regular teeth, the inner one is formed by this membrane, split into a fixed number of attenuated segments.

Sometimes, though very rarely, the stoma is furnished with a dense horizontal epiphragma, not accompanied with teeth (as is the case with the epiphragma of *Polytrichum*), an instance of which occurs in *Lyellia*; or, what is still more curious, is supplied with a pencil of fine capillary ciliæ, as is exemplified in *Dawsonia*. It is remarkable that these ciliæ apparently arise from around the summit of the columella, as well as from the walls of the theca. This, however, will not appear so singular, when we consider that the summit of the columella may nearly fill up the stoma,—and that, in the case of a membranaceous peristome, it is not uncommon for the peristome, or a part of it, to lose its attachment to the theca, and adhere to the periphery of the summit of the columella. This has occurred to ourselves, particularly in *Leptostomum erectum*; and we have little doubt, that what Dr Hooker figures as an elongated columella in several of his new *Orthotrica* is a similar instance *, thus rendering their affinity apparently more striking to *Schlotheimia* of Schwægrichen: the opercular membrane it will be found is not on the summit of, but in the interior of, the upright one.

There are several other modifications of the peristome,

* Musci Exot. Tab. 24. 127. and 128.

which it is scarcely necessary to mention here, such as occur in *Fontinalis*, *Cinclidium*, *Conostomum*, &c.: they will all be particularly described when we come to treat of these genera *.

There is only one other part of which we conceive it proper to make some mention, *viz.* the Calyptra; a membranaceous veil, which is situated upon, and more or less covers the theca. It is the upper portion of what in a young state is the covering of the theca, and which in a short time tears transversely towards its base. From this body, which is either fugacious or persistent, excellent generic characters may be drawn. It is either dimidiate, mitriform, or campanulate; and sometimes, as in various *Orthotrica*, is cleft into numerous, long, narrow laciniæ, or strap-shaped segments: its surface is smooth, or pilose, or even hirsute; plane, striated, or sulcated. In some instances it is furnished at its base with ciliæ, or a kind of lobes, as in some *Encalyptæ* and *Orthotrica*; but though we can scarcely call them adventitious, they appear to be of a more tender texture than the calyptra itself: they are probably portions of the pellicle of the vaginula, or that body of which at an early period the calyptra formed a part, and from which it was torn by the maturing of the theca.

On the other kind of fructification, the small pedicellated and reticulated bodies, described by authors as anthers, and likewise generally enveloped in perichætial leaves, we shall also make no comments in this place, nor even afterwards, unless extremely remarkable, since they are equally difficult to detect, and unsatisfactory when employed as characters.

* The terms of inner and outer peristome, we think almost unnecessary to change, being as applicable, after the above explanation, as hitherto.

MUSCI.

DEF. *Fructification* double; lateral or terminal, and generally surrounded by leaves differing in form from those of the rest of the plant.

I. THECA unilocular, one or four valved, furnished with an *operculum* and *calyptra.* The operculum is either adnate, as in *Phascum*, *Voitia*, and *Andræa;* or deciduous from the mature theca, and then displaying the mouth, or *stoma*, of the latter, which is either naked, or variously furnished with a membrane, or fringe (*ciliæ*, *dentes*). The calyptra, when young, envelopes the theca, but, as it advances to maturity, tears transversely through the middle; the lower portion is then called *vaginula*, and is permanent; while the upper part, or true *calyptra*, accompanies the theca, even when it is raised by a seta or fruit-stalk, and is more or less fugacious, very rarely persistent. Sporules generally very numerous, without spiral filaments, and, with a few apparent exceptions, surrounding a central columella. Columella variously modified, generally cylindrical, sometimes with large longitudinal plicæ or folds, and, in some instances, so expanded at its summit as nearly to close the stoma of the theca.

II. Small pedicellated, reticulated BODIES; they are either enveloped in leaves of a peculiar form, or are entirely naked: in the one case, the whole stem, or *caulis*, is closely beset with leaves; in the other, the leaves become gradually smaller, so as ultimately to disappear considerably below the *capitula*, or little heads, which these masses

of fructification form. Both kinds are sometimes present in the same plant; both are endowed with a reproductive power, and are most abundant when the first kind of fructification (the *theca*) is least to be met with.

VEG. " Plants of small size, of a more or less compact cellular structure, readily reviving upon the application of moisture, after being dry; bearing leaves, which are very rarely divided, often nerved, entire, or toothed, or serrated at the margin." The leaves, though sometimes so minute as to be invisible to the naked eye, are never totally absent.

GEN. I. ANDRÆA, *Ehrhart.*

FRUCTIFICATIO. *Receptaculum* haud pedicellatum, plus minusve elongatum, lineam vel sesquilineam longitudine superans, foliis perichætialibus paulo longius, album, succulentum, vasculosum, cylindraceum, ad basin in bulbilli formam intumescens, ad apicem thecæ apophysin sustinens. *Calyptra* tenuis, pellucens, albida, laxe reticulata, thecam juvenilem obtegens, basi receptaculum summum arcte adnata; demum ut theca evadat, subhorizontaliter et irregulariter disrumpens, valde fugax. *Seta* nulla, thecâ, vel potius *apophysi* ejus oblongâ vel turbinatâ, fuscâ, substantiâ pulposâ impletâ, receptaculum insidente. *Theca* intense fusca, cylindracea, demum subquadrangularis, in quatuor valvas æquales longitudinaliter dehiscens; quæ exsiccatione, apicibus semper operculo connexis, operculoque per valvarum involvescentiam detracto, in semicirculum eleganter arcuatæ. *Operculum* (conjunctorium, EHR.) minutum, conicum, obtusum, vel thecæ concolor aut albescens. *Peristomium* nullum ob operculum thecæ valvarum extremitatibus cohærens. *Columella* thecæ fere longitudine, cylin-

dracea, pallide fusca, subrigida. *Sporulæ* minutissimæ, numerosæ, fuscæ, sphæricæ, obsolete reticulatæ.

Char. Diff. *Theca quadrivalvis; valvæ apicibus operculo connexis.*

Fructification. The *receptacle* may be said to be sessile, but is elongated so as to resemble a seta, overtopping the perichætial leaves, until it sometimes reaches the length of a line and a half: it is white, succulent, vasculose, and cylindrical; the base swelling out into a small bulb, while the summit sustains the subturbinate apophysis of the theca. The *calyptra* is thin, pellucid, whitish, and loosely reticulated, adhering, when young, to the top of the receptacle, and then entirely inclosing the theca; it separates early, and is torn transversely in a very irregular manner, the upper portion, or true calyptra, being exceedingly fugacious. There is no *seta*, the theca, or, more strictly speaking, its *apophysis*, which is full of a pulpy substance, being seated on the receptacle. The *theca* is of a deep brown colour, cylindrical in its young state, ultimately subquadrangular, and splitting longitudinally into four equal valves, whose summits are always bound together by the persistent operculum. In dry weather, the operculum is drawn down by a tendency in the valves to become involute, which causes them to be bent outwards, until they almost form a semicircle, and the theca becomes turban-shaped. The *operculum* is small, conical, and obtuse, either similar in colour to the theca, as in *A. alpina* and *nivalis*, or whitish, as in the other two species. There is no *peristome*. The *columella* is cylindrical, nearly equal in length to the theca, pale-brown, and of a somewhat rigid texture. The *sporules* are minute, numerous, brown, spherical, and obscurely reticulated.

DIFF. CHAR. *The theca is four-valved; valves cohering at their apices by means of the persistent operculum.*

VEGETATION. The stems (*caules*) are branched, seldom more than half an inch long in two species, while in *A. nivalis* they reach sometimes five or six inches. The leaves are ovate, and, from being more or less suddenly acuminated, pass into lanceolate; a dark-brown, or even almost black, colour is common to them all, yet they are sometimes inclined to yellow. Two of the species have secund leaves, while a third possesses that character only at the summits of the branches: the other, *A. alpina*, has all the leaves erect, or erecto-patent. The order, however, of the distribution of the nerves of the leaves seems to be inverted. *A. alpina* and *rupestris* are entirely destitute of a nerve; *A. Rothii* has a nerve in all, except the perichætial leaves; while *A. nivalis*, in both the perichætial and cauline leaves, is furnished with a very strong one.

OBSERVATIONS. The truly sessile theca seems to ally these plants most strongly to *Sphagnum*, but that is the only point in which they can be said to bear any resemblance to each other. The four-valved theca is a character by which the species of this curious genus may be separated from all other known mosses; and notwithstanding the central columella, the robust habit, the sporulæ destitute of *elateres* or spiral filaments, and leaves (in two species) furnished with nerves, one can scarcely wonder at some of the older Botanists regarding them as *Jungermanniæ*. In a natural arrangement, therefore, they form an admirable link between the HEPATICÆ and the MUSCI.

What we term Theca is very different from what was here so called by HEDWIG. According to him, our theca were teeth, and our apophysis his theca: thus directly at

variance with EHRHART, who had previously, and most accurately, described them. Both HEDWIG and EHRHART have, however, we conceive, fallen into an error, by describing the elongated receptacle as a pedicellus or seta. That we are correct in our denomination of these parts, (and we are not the first), is, we think, clearly proved; by the sporules being never found in the apophysis, but always in the cavity formed by the four valves; and by the texture of these parts and that of the receptacle. For those who believe in the *stamina* and *pistilla* of mosses, we may add, that the latter are arranged along our receptacle.

HABITAT. All the four species are natives of Great Britain, but are by no means confined to it. Three are common on all the mountainous rocks of Europe; but *A. nivalis* has been detected only on the summit of Ben Nevis in Scotland, and on some of the more elevated of the Swiss Alps. Hitherto none of the species have been found out of Europe, to whose rocks Nature seems to have restricted them.

HISTORY. Two of the species were described by LINNÆUS under the names of *Jungermannia alpina* and *J. rupestris*. From the latter, Dr MOHR was the first to separate *A. Rothii*, on account of the presence of a nerve in the leaf, a species which is retained (without a figure) by SCHWÆGRICHEN, but excluded by BRIDEL in his "Methodus nova Muscorum," and again reduced under *A. rupestris*, with the (*amended!*) character—"caule simpliciusculo, foliis laxis imbricatis lanceolato-subulatis falcatis secundis, *nervosis*, perichætialibus æqualibus mucronatis," which would almost incline one to believe that he had seen neither the one nor the other. Both species must, however, be kept up. Lastly, Dr HOOKER has discovered to us, both in Scotland

and Switzerland, *A. nivalis*, the largest, and, *A. alpina* excepted, the most beautiful of the whole. To the full account published by that excellent naturalist, in the 10th volume of the Linnean Transactions, of the four species, we have been greatly indebted, particularly, it will be perceived, in drawing up the characters of the genus. We have therefore followed him in his examinations, but have described nothing that we ourselves have not verified.

The error which LINNÆUS committed (he used to boast that he never employed a microscope), and which he borrowed from DILLENIUS, arose from overlooking the columella; but this would have been corrected in the "Methodus Muscorum" of the younger LINNÆUS, had he not indignantly cancelled the sheet as written by EHRHART, and retained the original descriptions of his father. The genus *Andræa* was, however, established by EHRHART (Ehr. Beyträge, i. p. 15. and 180.): it was retained by HEDWIG in the posthumous work "Species Muscorum," as also by SCHWÆGRICHEN in his Supplement, but both place it next to *Tetraphis*, among the mosses furnished with a peristome; deceived probably by the supposition, that in maturity, the operculum would fall off. This, however, we have stated, never really to separate of its own accord; and, indeed, SCHWÆGRICHEN adds, "Peristomii dentes in speciminibus nostris non satis maturatis emollitis forte conglutinati." He also elsewhere remarks, "Melior forte locus ad muscorum finem *Andreææ* designaretur," where it has been since placed by BRIDEL. But instead of the conclusion, we think the commencement of a system of Mosses is the most appropriate situation for *Andræa*, as it forms a link of union between the HEPATICÆ and the MUSCI; the former of which orders being the least perfect, must consequently precede the latter in a proper natural arrangement; and in such an arrangement of Musci, both *Andræa* and

Sphagnum, each *sui generis*, must, as it were, stand intermediate.

PLATE VII.

Fig. 1. Theca of *Andræa alpina*, before it has separated into four valves. The ragged vaginula is seen at the base of the small apophysis; and towards the bottom of the elongated receptacle are situate the abortive pistilla.

2. Theca of the same, in a dry state. After the sporules have escaped, the columella is seen, and is shorter than the theca.
3. Calyptra of the same.
4. Sporules.

All the figures are more or less magnified.

GEN. II. SPHAGNUM, *Dill.*

FRUCT. *Receptaculum* lenticulare, seu in clypeolum planiusculum horizontaliter dilitatum, albo-fuscescens pseudopedicellatum, pedicello pallidiore, semiunciam ad sexcunciam longo, crasso, siccitate paulum tortili. *Calyptra* pallens "veli albi instar," tenerrima, tunc thecam arcte circumcingens, et thecæ basin adnata, nunc transversim et irregulariter dehiscens; cujus pars inferior, vel vaginula receptaculo adhæret, parsque superior, vel calyptra, proprie dicta, valde fugax est. Nec *seta* nec *apophysis* ulla. *Theca* integra, ovata, globosa, urceolata, aut turbinata, in eadem specie varians; ore amplo; brunneo-fusca, lævis, receptaculum immediate insidens. *Operculum* planiusculum, seu convexum, matutine deciduum, thecæ concolor. *Peristo-*

mium nudum. *Columella* prima ætate, magna, ampla, sed una cum membrana operculari, postea ita deprimitur, ut membranam thecæ maturæ fundum obtegentem simulet, et nulla dicatur. *Sporulæ* vel pauco-angulatæ, superficiebus convexis, imperforatis; vel subsphæricæ reticulatæ.

CHAR. DIFF. *Theca integra in receptaculum sessilis.*

FRUCT. The *receptacle* is in the form of a lens, or, in other words, is dilated horizontally into a much flattened oblate spheroid; of a brownish-white colour, and apparently pedunculated, the peduncle being somewhat paler, varying in length from half an inch to an inch and a half, or more, and of considerable thickness,—rather liable to be twisted when dry, and probably a continuation of the caulis or stem. The *calyptra* is of a pale colour, "like a white veil," remarkably tender, at an early period entirely inclosing the theca, and bound to its base at its conjunction with the receptacle, but soon tearing transversely and irregularly through the middle. Its lower part, or vaginula, still continues to adhere to its place of attachment; but the upper portion, or true calyptra, is very fugacious. Neither *seta* nor *apophysis* can be said to be present, the receptacle forming the immediate support to the theca. The *theca* is entire, ovate, globose, urceolate or turbinate; and all these modifications frequently occur in the same species: it is generally widened at the mouth, of a rusty-brown, with its surface destitute of either striæ or sulci. The *operculum* is somewhat plane, or inclining to convex, and similar in colour to the theca, from which it is at an early period detached. The *peristomium* is naked. The *columella* in the young theca is of no small dimensions, but, by the drying up of the pulp which it contains, sinks along with its opercular membrane so low, as to present the appearance of a mere horizontal

tympanum, stretching across the interior of the theca, a little way above its base. The columella, therefore, taken with a view to the mature theca, may justly be described as absent. The *sporulæ* are in some cases almost pyramidal, with their sides convex and imperforated; in others, subspherical and reticulated.

Diff. Char. *The theca is entire, and sessile on the receptacle.*

Veg. The stems are for the most part branched, and, from the influence of locality, or other causes, vary in length from one inch to above four feet. The leaves of none of the species are furnished with nerves; in their form they are liable to the greatest variation, passing through ovato-obtuse, ovato-acuminate, lanceolate, into lanceolato-subulate. They are either adpressed or recurved, or perhaps even secund, thus causing the extremities of the leaves to be sometimes obtuse and tumid, and sometimes attenuated. A remarkable pale-yellowish or greenish-white colour, varied in some instances with a tinge of pink, is common to the whole genus. Their texture is also peculiar, being so tender as to render the apices liable to erosion, a circumstance which is aided by the repeated changes of climate, naturally arising from their situation. This erosion has been made a ground for the constitution of species, by Schwægrichen and others; but it is a character which, with Dr Hooker, we consider of no importance, and not even constant to any one, and to which, therefore, we cannot of course give our consent. The reticulation is no less curious, and is sufficient to distinguish this genus from nearly all others; it consists of oblong, longitudinal, flexuose, nearly regularly formed cellules, always interrupted by transverse lines. In one species (*S. squarrosum*) there are also

circular lines independent of, and sometimes intersecting the transverse ones, and chiefly situated at the extremities of the long cellules.

The perichætial leaves differ considerably in these plants from the cauline ones, and at an early period totally envelope the theca, scarcely bursting before it has attained its full size. At this time, especially in a dry state, they are remarkably scariose; and from being, as it were, so glued together, as to prevent the form of each being visible, the whole bears no small resemblance to the calyx of some of the *Jungermanniæ*.

Obs. The species or varieties of this genus are easily distinguished from those of all the other known genera. Their nearest artificial affinity is to *Andræa*, from which they are at first sight separated by the entire theca, deciduous operculum, and apparently pedunculated receptacle; which last, combined with the absence of a seta, affords a distinctive mark from another series of allies, the *Gymnostomoideæ*. We have, under *Andræa*, mentioned our reasons for considering the theca sessile: the same apply also to the present genus. We allude to the difference between the apparent peduncle and all true setæ; and for the close followers of Hedwig, to the situation of the pistilla, which are here formed immediately beside the theca, on the summit of what we term the receptacle. But there is another circumstance, which, although we omitted to state under *Andræa*, applies no less to it, than to the genus under consideration. Hedwig, among his definitions, describes *vaginula*—"Membrana tenuissima, pedunculi basin involvens *prima ætate calyptræ continua*;" yet we find him describing both *Andræa* and *Sphagnum* as possessing setæ. But it ought to be remarked, that Hedwig, in consequence of his hypothesis of the constant presence of a true seta, was

led to call our vaginula a portion of the calyptra; and, resting on the former part of his definition—"pedunculi basin involvens," and disregarding the latter and more important clause, searched for the vaginula at the base of his seta, and therefore declared *Sphagnum* to be destitute of it. Accordingly, we find that BRIDEL, following up the same most unphilosophical conclusion, separates it from all the other Mosses, and constitutes for it a distinct section, "*Musci Evaginulati.*" Why they did not equally include in this arrangement the former genus *Andræa*, or rather, what it is that in it they term "*vaginula vix ulla*," we really confess we do not comprehend. In both, however, it will be found that the true vaginula, or remainder of the calyptra, "*prima ætate calyptræ continua*," is fixed immediately below the theca, and to the summit of what we and some others denominate the receptacle, or what HEDWIG called the apophysis. We have already taken notice of the peculiar appearance exhibited by the perichætial leaves in a young state, and have now only to add, that, by degrees, as the theca advances to maturity, the caulis or stem is prolonged into the setiform body, which supports the receptacle; thus separating the perichætial leaves, which now become more evidently distinct from each other, and (as is indeed represented in all the best figures of the species) are scattered along it a considerable way:—a circumstance which also militates against HEDWIG's hypothesis of the seta; that body, in Mosses, being always destitute of leaves, and having the perichætial ones situated around its base.

HAB. All the species hitherto described are confined to damp or wet situations. They have been found not only in Europe, but in North and South America; and probably there are few countries in the whole world, which,

in the process of time, they will not be found to inhabit. In general, where they do occur, extensive peat or turf bogs, as in Britain, Germany, and Sweden, are found to be almost entirely formed by them.

HIST. DILLENIUS *, who first, in a system of Muscology, constituted this genus, defined it, "Musci genus capsulas uniformes proferentis, quæ capsulæ ab aliis differunt, quod nudæ sint, seu calyptra destitutæ," &c. LINNÆUS, however, finding a calyptra in many of those described, removed several of them to the *Hypna*, and to a new genus of his own formation, *Phascum*,—"Anthera operculata ore ciliata, calyptra caduca minuta," wherein it may be seen he had altered the nomenclature of DILLENIUS. He still, however, kept up, with very little variation, the former definition of *Sphagnum*—"Anthera operculata; ore lævi, calyptra nulla," retaining under it *Sphagnum alpinum* and *S. arboreum*. In the true *Sphagna*, the erroneous definition is accounted for by the remarkably fugacious and delicate nature of the calyptra. That it really possesses one, is now placed beyond a doubt; but it generally falls off at the time the theca emerges from the perichætial leaves; and it is even difficult before that period to remove those leaves without also detaching it.

The two other plants comprised in this genus by LINNÆUS, *S. alpinum* and *arboreum*, have been generally referred, in later times, the one to *Dicranum*, the other to *Neckera*; but in neither is the calyptra of so fugacious a nature, as to apologise for such a mistake even among the

* DILLENIUS, though this generic name had been previously applied to plants, was the first to restrict it to the Musci.

early botanists. The only other plant that has been referred to this genus, is one of more recent discovery; *S. Javanense*, or *irridans* of BRIDEL, or *S. clandestinum* of PALISOT DE BEAUVOIS. It has been since removed by BRIDEL, in his "Methodus nova," with much more justice, to *Dicranum*, near *D. glaucum*, under the name of *D. megalophyllum*. The structure of the leaves is not very unlike to *Sphagnum*, from the cellules being crossed with transverse lines; but the cellules themselves are very different, being oblong and quadrangular, and possessing nothing of that undulating character so peculiar to *Sphagnum*. The fructification has never been discovered, unless it be the same as a *Dicranum*, which Dr HOOKER has observed in Mr TURNER's rich Herbarium.

The genus *Sphagnum*, as it is now universally received, is a very natural one, and therefore liable, like all such genera, to be reduced to too few, or extended into too many species. Two of the present species were figured by DILLENIUS, while LINNÆUS introduced them under α and β of his *Sphagnum palustre*. These were made by HEDWIG distinct species. WEBER and MOHR added other two, *S. cuspidatum* and *squarrosum*, which last was probably intended by HEDWIG to come under his *S. latifolium*. BRIDEL described *S. Magellicum*, *compactum*, and *simplicissimum*. Three out of the above enumerated species were first correctly delineated by SCHWÆGRICHEN. It would, however, be useless to trace all the changes that have been made in this genus by different authors. We shall only observe, that PALISOT DE BEAUVOIS added what he conceived to be two distinct species from North America; and BRIDEL has latterly, in his "Methodus nova Muscorum," or fourth part of his "Muscologiæ recentiorum supplementum," enumerated seventeen, with one (*S. simplicissi-*

num *) the genus of which is doubtful. It is not our intention to state, under these generic characters, what we consider to be good species, or what merely varieties; but we cannot refrain from expressing our opinion, that, notwithstanding the apparent striking difference between some of the *Sphagna*, and the peculiar structure that is exhibited in all the leaves of *S. squarrosum*, which we have examined, it is not improbable, that at some future period the old Linnæan species may be again adopted. We cannot, in this place, do better than give BRIDEL's observations at the end of the genus, in nearly his own words.

"Genus *Sphagnum* inter omnia maxime naturale, proprio Marte stans, nec ulli alteri affine. Ramorum nempe ad caulis latera dispositione fasciculari aliis muscis alienissimâ, foliis semper concavis, integerrimis, areolisque plus minusve trapeziformibus, a cæteris gentis nostræ generibus longe removetur. Unicam insuper speciem diceres, jam innuantibus TREVIRANO et RÖHLINGIO, per varietates multas certos inter se limites non admittentes diductam. A *cymbifolio* et enim, cui forte conjungenda *compactum* et *condensatum*, quippe quæ non aliter quam ramulorum fasciculis approximatis indistinctis ab eo recedunt, mediantibus *tenello* et *patenti*, contra MOHRI assertionem qui transitum talem temere negat, ad *squarrosum* devenimus sese iterum cum *capillifolio* ex habitu arctius connectens, quod a *subulato* et *ericetorum* vix specifice diversum, tandem in *cuspidatum* mediante *pentasticho* abit. Hinc si leviora discrimina a foliorum reticuli areolis majus minusve dilitatis aut

* We have never observed this species in any of the herbariums abroad that we have visited, unless it be a plant that we received by the kindness of M. B. DELESSERT, from the collection of PALISOT: this, however, which is nearly quite simple, of a pinkish hue, and has leaves broadly ovate and obtuse, we consider only a singular variety of *S. obtusifolium*.

coarctatis desumpta negligantur, fatendum est thecæ structuram uniformem et constantem, foliorum formam per gradus intermedios sensim et absque salebra leviter immutatam, ramulorum denique dispositionem in *Sphagno* peculiarem solemnemque unicam speciem in genere unico promulgare videri. Non possumus tamen plures species non admittere potius ex habitu, colore, &c. quam ex ullo charactere firmo, constante genuinoque dignoscendas."

In addition to the above, we have only to add, that we ourselves possess several additional connecting links between the varieties; but that, for the present, we follow HOOKER and TAYLOR * in keeping up the four species, *S. obtusifolium*, *squarrosum*, *acutifolium*, and *cuspidatum*, to some of which all the others (though sometimes, we confess, with difficulty) may be referred: and these, if all are afterwards again reduced to *S. palustre*, will form the types of the varieties.

PLATE VII.

Fig. 5. Theca of *Sphagnum squarrosum*, before it has emerged from the perichætial leaves. Some of the perichætial leaves are removed. The ragged vaginula is very evident, springing from the receptacle; as also some abortive pistilla (*Hedw.*)

6. Mature theca of a *Sphagnum*, showing the naked peristomium, and the vaginula and barren pistilla as before.

7. Operculum.

8. A young theca cut open, to show the columella.

* Muscologia Britannica, p. 4.

9. *a*, Spherical and reticulated sporules of *S. squarrosum.* *b*, Deltoideo-pyramidal sporules of *S. acutifolium.* See also SCHWÆGR. Suppl. Tab. 5. fig. 9.
10. A portion of a leaf of *S. obtusifolium*, to show the reticulations and transverse striæ.
11. A portion of a leaf of *S. squarrosum*, showing, besides a variation in the form of the areolæ, curious circular lines of the same nature as the transverse ones.
12. Section of the stem of *S. obtusifolium.*

All the figures are more or less magnified.

PHASCOIDEÆ, *Gen.* (3—4).

CHAR. *Receptaculum haud pedicellatum, sed intra folia perichætialia sessile. Calyptra dimidiata, aut fugax aut persistens. Seta longitudine et colore valde varians. Theca integra non angulata. Operculum persistens obliquum. Peristomium nullum.*

CHAR. *The receptacle is sessile. The calyptra dimidiate, in some very fugacious, in others persistent. The seta very variable with respect to colour and length. The theca entire, and without angles. The operculum persistent and oblique, inclining to rostrate. There is no peristome.*

OBS. We have been obliged to have recourse, more to the structure of the theca, than to any peculiar habit in the plants forming this tribe; indeed there are few genera, with terminal setæ and entire capsules, to which they do not bear some affinity. The above character is therefore

employed, as they cannot assimilate under any other group. The persistent operculum brings them near to *Andræa*, to which in habit they are most remote; and so long as generic characters are taken from the fruit, they must be ever kept separate from all peristomed mosses.

Gen. III. Phascum, *Linn.*

Fruct. *Calyptra* dimidiata, fugacissima, theca in nonnullis paulo brevior, in plurimis minima, tenera, albescens, laxe reticulata. *Seta* terminalis, innovatione interdum quasi lateralis; plerumque brevissima albo-virescens tenera; aliquando tamen, ut in *P. bryoide*, duo ad sex lineas longa, brunnea rigidior. Thecæ *apophysis* sæpius nulla, sed in *P. splachnoide*, monente Hornschuchio, præsens. *Theca* a setâ decidua, integra, lævis, subglobosa vel ovata; sæpius et interdum eleganter reticulata; brunnea vel brunneo-fusca; quandoque (ut in *P. crassinervio* et *cuspidato*) tunica singulari cincta, tunicâ juniore "crassâ, subcarnosâ viridi-pallida pellucida," maturiore et siccâ calyptram magnam scariosam indehiscentem referente. *Operculum* obliquum thecæ paulo tenerius, nunquam abscedens, sed ita thecam adnatum, separationisque linea tam tenuis, ut operculum nullum, sed thecæ acumen breve, tyro diceres. *Peristomium* nullum. *Columella* dicta valde variabilis; in *P. recto* et *curvicollo* conspicua, prælonga; in plurimis brevior et fere nulla. *Sporulæ* majusculæ tuberculosæ angulatæ; numero variantes, in *P. alternifolio* sedecim tantummodo, in *P. serrato* circiter centum.

Char. Diff. *Theca a setâ decidua; calyptra brevis, fugax.*

FRUCT. The *calyptra* is dimidiate, and very fugacious; in some species, only a little shorter than the theca; in most, however, much shorter, and small in size: it is tender, of a whitish colour, and reticulated. The *seta* is terminal; sometimes apparently lateral, in consequence of innovations; generally short, of a greenish-white colour and delicate texture; sometimes reaching the length of from two to six lines, when it is browner, and more rigid. An *apophysis* to the theca is a rare occurrence, but such a structure has been described by Dr HORNSCHUCH to exist in one species, P. *splachnoides*. The *theca* is deciduous from the summit of the seta, entire, somewhat globose, or ovate, and not striated; generally reticulated, but sometimes most beautifully and regularly chequered with transverse bands: the colour is more or less of a deep-brown; in one or two instances, as in *P. crassinervium* and *cuspidatum*, it is, in a young state, completely surrounded by a remarkable coating of a thick subcarnose, pale-green and pellucid substance, which, when dry, bears a strong resemblance to a large scariose calyptra previous to laceration. The *operculum* is oblique, of a more tender structure than the theca, never deciduous, but so united to the theca, and having the line of separation so inconspicuous, that one would almost be disposed to call it, less an operculum, than a short oblique termination of the theca. There is no *peristome*. The *columella* is here very variable; long, and easily observed in *P. rectum* and *curvicollum;* but in most others, short, or apparently absent. The *sporules* are large for the size of the theca, angled, and tuberculated, varying much in regard to number, being 16 in *P. alternifolium*, and about 100 in *P. serratum*.

DIFF. CHAR. *The theca deciduous from the seta; the calyptra short, fugacious.*

VEGET. The stems are sometimes branched, but in the greatest number of the species extremely short. In *P. serratum* and *cohærens* they are apparently absent, but really present under the form of surculi, or creeping articulated conferva-like shoots, destitute of foliage, upon which the fructification with its perichætial leaves is sessile.

The cauline leaves of all the species are furnished with a nerve, and are in general reticulated. In this character, the perichætial leaves of *P. serratum*, *cohærens*, and some others, are remarkable, the cellules being large, and evident under a small power of the microscope. They vary in shape, from ovate, in *P. curvicollum* and *patens*, ovato-apiculate, in P. *rectum*, to lanceolate and subulate in other species. Their situation is generally along the stem, without any particular order; but in *P. alternifolium* they are beautifully alternate. Serratures are found in some few species, but those with subulate leaves are always entire. The perichætial leaves are for the most part uniform with the cauline ones; but in *P. alternifolium* they are much larger and longer, and surround the theca.

OBS. Two of the species of this genus are apparently at variance with the generic character, P. *alternifolium* and *axillare;* in both, the seta appears to be truly lateral. In consequence of this, BRIDEL has made a new genus of the former, under the name of *Pleuridium*—" Capsula lateralis inaperta decidens, calyptra decidua;" and adds another species, *Pleuridium globiferum*, from the Isle of France, which seems to be merely a variety. In P. *alternifolium*, the theca is, however, really terminal, or, at the summit of small branches, situated on the main stem. It is the shortness of this branchlet which deceived BRIDEL: but an accurate inspection shows, that it is also clothed with cauline leaves, and not with the long perichætial ones alone; the

seta cannot therefore justly be said to be axillary. The other doubtful species, *P. axillare*, is more deserving of a place under *Pleuridium*, and indeed Hornschuch seems to be at a loss what to do with it; but even here the seta is at first terminal. "Pedicellus primo ortu terminalis, at mox, producto caulis apice, lateralis *."

The *Phasca* can scarcely be said to possess a habit peculiar to themselves. Among those with short setæ, *P. alternifolium* resembles closely the shoots of *Dicranum varium*, while *P. cuspidatum* is frequently passed over by the tyro for barren stems of *Bryum cæspiticium;* those with the setæ exserted, especially *P. rectum* and *bryoides*, approach intimately to some of the *Gymnostoma* and *Weissiæ*, and more especially to what constitutes the following genus.

Hab. These plants are seldom found in lofty situations, but generally on moist banks, and open fields in the low countries. They abound chiefly in Europe; North America, however, possesses some; and the Cape of Good Hope two species, *P. nervosum* and *splachnoides*. We have also seen what we conceive to be a variety of *P. subulatum*, from King George's Sound, New Holland.

Hist. This genus, as we have formerly noticed, was ranked by Dillenius under his *Sphagna*, but was separated by Linnæus, under its present name. Only two, however, of his species prove to be true *Phasca*, and the remainder have been transferred to other genera. In Britain no more than these two appear to have been known in the time of Hudson, but this number was soon increased by

* Sir J. E. Smith, Flora Britannica, p. 1150.

the industry of various botanists. DICKSON added several to the British list: Mr TURNER, to whom muscology owes so much, describes nine species as natives of Ireland, in his excellent "Muscologiæ Hibernicæ spicilegium:" and Sir J. E. SMITH, in his "Flora Britannica," and also in his subsequent and more valuable work, the Compendium of the former, enumerates seventeen. Drs HOOKER and TAYLOR, having examined them with the utmost microscopical accuracy, found it necessary in their "Muscologia Britannica *," to reduce that number to eleven. In the mean time, HEDWIG, on the Continent, including a species from North America, raised the original number to twelve. SCHWÆGRICHEN, in his Supplement, describes seventeen; and, latterly, BRIDEL brings as many as twenty-seven species under *Phascum*, and two under *Pleuridium*, thus making no fewer than twenty-nine. Of these it is sufficient to say, that thirteen only can be established as good species. There is, however, one more (*P. Florkëanum*, with an English variety, *P. stellatum*, BRID.), but which, until we see better and more decided specimens than those at present in our possession, we cannot help thinking too closely allied to *P. muticum*, and its varieties,—a circumstance also noticed in the "Muscologia Britannica." Two species, as already mentioned, have been lately added; one by Dr HOOKER, in his beautiful "Musci Exotici," the other by HORNSCHUCH in the "Horæ Physicæ Berolenses;" so that at present only fifteen species can be enumerated of this extremely minute genus.

* This most excellent work is, we know, out of print; but we hope the public will speedily be favoured with another edition, which cannot but acquire an additional interest with the British muscologist, from the new materials that will enrich it.

PLATE VII.

Fig. 13. Theca of *Phascum curvicollum*.
14. Do. of *P. subulatum*.
15. Calyptra of *P. curvicollum*.
16. Sporules of *P. subulatum*.
All the figures are more or less magnified.

GEN. IV. VOITIA, *Hornsch.*

FRUCT. *Calyptra* dimidiata magna, thecâ paullo longior, persistens; dum basi cohæret, subcylindrica, integra, flavo-fusca, thecâ autem adultâ campanulato-conica, grisea, tenuis, lævis, glabra, altero latere deorsum fissa, sursum vero integra et thecæ tam arcte adglutinata, ut in maturitatem usque persistat, et non, nisi tempestatum et pluviarum injuriis demum excesa, solvetur. *Seta* terminalis, lineas octo ad quatuordecim longa, erecta, lævis, quandoque torta, carneo-purpurascens, "sub theca in discum infundibuliformem solidum dilitata," ex quo theca continuatur. *Apophysis* nulla, nisi discus sub theca prædictus. *Theca* integra, plus minusve ovata, lævis; matura, hinc inde collapsa, spadiceo-fusca, calyptra vestita, nunquam dehiscens, sed una cum operculo suo, basi humore et putredine soluto, decidua. *Operculum* semper adnatum, obliquum, attenuatum, theca texturæ laxioris. *Peristomium* nullum. *Columella* magna, thecâ brevior, oblonga, obtusa, albida, laxe cellulosa. *Sporulæ*, in cumulo griseo-virides, copiosissimæ, compactæ, exiguæ, sphæricæ, læves, tres vel quatuor loculorum vel sporulorum quasi constitutæ.

CHAR. DIFF. *Theca cum seta decidua; calyptra magna persistens.*

FRUCT. The *calyptra* is dimidiate, as long, or even longer, than the theca, and persistent; while it is attached by the base, it is nearly cylindrical, entire, and of a yellowish-brown colour; as the theca becomes old, it changes to campanulato-conical, and is of a greyish hue, slender, smooth, unfurrowed, splitting from the bottom upwards on one side, but entire above, and so closely cemented to the theca, that it remains attached till maturity, and is not even then loosened, unless by injuries caused by the vicissitude of the seasons. The *seta* is terminal, from eight to fourteen lines in length, erect, and smooth, but sometimes slightly twisted; of a purplish-red colour, and "dilated under the theca, into a funnel-shaped solid disk," of which the theca is a continuation. There is no *apophysis*, unless the above mentioned disk beneath the theca can be considered as such. The *theca* is entire, more or less ovate, smooth, when mature here and there collapsed and wrinkled, of a reddish-brown colour, and clothed with the calyptra; it is never dehiscent, but falls along with its seta, whose base is putrified and corroded by a superabundance of moisture. The *operculum*, which is, as it were, firmly bound to the theca (from which it differs, in being of a looser texture), is oblique and attenuated. There is no *peristome*. The *columella* is large, a little shorter than the theca, oblong, obtuse, whitish, and cellular. The *sporules*, viewed in the mass, are of a greyish-green colour, very plentiful, extremely minute, spherical, smooth, apparently tri-quadri-locular, or as if three or four smaller sporules were cemented together.

DIFF. CHAR. *The theca falls along with the seta; calyptra large and permanent.*

VEG. In one species the stems are scarcely more than three-fourths of an inch in height, but in the other they reach from two to three inches: they are either simple or branched, and so closely matted together (at least in *V. nivalis*), that it is extremely difficult to separate a complete plant from the mass. The leaves are imbricated, erecto-patent, of a yellowish-green colour, ovate, more or less concave, scarcely acuminate in one, and considerably so in the other species, very entire, embracing the stem at their base, with a strong brown nerve reaching to the apex; their reticulation is large, and nearly rectangular; the perichætial leaves are much more acuminated, tender in their structure, but equally furnished with a strong nerve.

OBS. Few plants are more remarkable than those which form the present genus. Their closest affinity is to *Phascum*, especially *P. bryoides*; but the persistent calyptra of *Voitia*, and what is of much greater importance, the theca, deciduous only along its seta, must for ever keep them distinct; while, on the other hand, the adnate operculum is sufficient to separate them from all other mosses that may resemble them in habit. Among those with which they might at first be confounded, are, the *Encalyptæ* and *Splachna*, and even some of the *Brya*.

HORNSCHUCH, in his "Commentatio de Voitia et Systylio" (from which, by changing the terms, we have borrowed nearly the whole of our description of the fructification), describes the theca of his species—"ovata in acumen subobliquum, truncatulum, pellucidulum attenuata," while he denies it to possess an operculum; so far we do not agree with him, and have accordingly denominated the termina-

tion of the theca an Operculum. This is not the result of caprice; for it will be found that the oblique attenuated point is destitute of sporulæ, and that the sporular bag actually terminates at the summit of the ovate portion of the theca, to which, therefore, the term Theca can only be applied. The more pellucid appearance in the acuminated summit, as observed by HORNSCHUCH, was owing to this absence of sporulæ; we therefore consider it as a true operculum. He adds also, that it is of a different texture,—"texturæ laxioris." We shall close these observations with another remark from that learned Professor, but which we ourselves have not been able completely to verify; *viz.* that the vaginula, in this genus, is composed of two valves. In all mosses, at an early period, the vaginula and calyptra are one and the same; the latter is, by the enlargement of the theca, torn from the lower portion, and each part then receives a distinct name, and becomes independent of the other. In *Andræa* and *Sphagnum* this is peculiarly visible; the portion left at the base, now called Vaginula, is generally entire, and it is so in *Phascum*. On this character, the above mentioned commentator lays much stress in his diagnosis of the two genera; but we do not see that it is of so much importance as the points we have already enumerated.

HAB. These plants have hitherto only been found on the summit of the Carinthian Alps and in Melville Island. We have not been able to ascertain whether those brought from the latter place grew upon the dung of animals, as was the case with those discovered by Dr HORNSCHUCH: from our specimens we should rather imagine the contrary.

HIST. Dr HORNSCHUCH was the first fortunate discoverer of this curious genus in 1817, a figure and descrip-

tion of one species of which he published in 1818. An excellent figure is also given by Dr HOOKER of the same in his "Musci Exotici," taken from specimens communicated by Dr HORNSCHUCH. This genus, though of such recent discovery, was again met with soon afterwards in a different part of the world, Melville Island; in which some specimens were collected, and from whence they were brought to this country by Captain SABINE, who accompanied Captain PARRY in his late adventurous and ever memorable Arctic expedition. Although the quantity from that habitat was small, yet having observed plants of it in the possession of two or three individuals, always retaining the same characters, and having examined our own specimens minutely, we have been induced, on really finding them to differ materially from the plants gathered by Professor HORNSCHUCH, to propose them as distinct species, with the following characters:

1. Voitia nivalis, *caule elongato ramoso; foliis ovato-lanceolatis, concaviusculus, notabiliter acuminatis; theca oblongo-ovata; operculo obtusiusculo.*
2. V. hyperborea, *caule elongato subsimplici, foliis late ovatis vix acuminatis, valde concavis; theca ovato-globosa; operculo acuto.*

1. *Voitia nivalis.* Stems elongated, branched; leaves ovato-lanceolate, slightly concave, much acuminated; theca oblongo-ovate; summit of the operculum rather obtuse.
2. *V. hyperborea.* Stems elongated, nearly simple; leaves broadly ovate, sub-acuminate, very concave; theca ovato-globose; summit of the operculum acute.

PLATE VII.

Fig. 17. Theca of *Voitia nivalis*, with its calyptra.

18. Theca of the same cut open, to show the columella, on the summit of which are traces of the membrane which closes the stoma.

19. Theca of *V. hyperborea* (nobis).

20. Sporules; which are the same in both species.

21. Leaf of *V. hyperborea.*

22. A portion of the leaf of either species, showing the form of the areolæ.

All the figures more or less magnified

X.—*Short Account of the Rocks in the Neighbourhood of St John's, Newfoundland.*

By Mr John Baird.

(*Read 23d February* 1822.)

In approaching the fishing grounds on the coast of America, the soundings were from sixty to thirty fathoms; over the great Bank of Newfoundland, generally about thirty-five. The lead brought up a fine sand, and frequently small pieces of a rough flint, together with particles of a green smooth mineral, in the form of coarse green sand. It is certainly a singular fact, that so large a portion of shallow water should exist so far out at sea, the sea deepening so rapidly beyond the Bank. Is it not probable that a large tract of dry land had formerly existed where the Bank is now found? The rocks which formed this land may have been composed of very soft materials, and the occurrence of flint and green sand over the Bank seems to indicate that the greater part of the original rocks had been of the Chalk and Green Sand Formations. A country composed of these rocks, which are of

the latest formation, must have been very low, and in conquence much exposed to the action of the sea. By degrees the whole may have been inundated and entirely swept away, leaving the harder debris, the flint and green sand, to form the gravel at the bottom.

The coast round St John's is bleak, bare, and rocky, and almost everywhere precipitous. On both sides of St John's harbour, perpendicular cliffs of trap-tuff rise to the height of three or four hundred feet. The interior of the country is hilly, but does not rise to a great elevation, few of the hills being more than five or six hundred feet above the level of the sea. They are generally round-backed, and frequently wooded to the top. The whole uninhabited part of the country is one immense forest, consisting chiefly of fir and birch. No extensive valleys or plains occur, but hill succeeds hill in almost unvarying succession. The physiognomy of the country is an elegant outline of hill and dale: the scenery, however, wants variety. Lakes are numerous over the whole island, as far as it is known, and many of them, near the coast, are large and beautiful. They occur even on the tops of the hills, and are said to be often of great depth. The soil is in general light. Oats and barley thrive; and potatoes, turnips, and other kitchen vegetables, grow fully as well as in England. Summer weather, in Newfoundland, is short, but warm, and very favourable to vegetation. The winter is uncommonly severe, the spring and autumn very changeable. There is good pasture for cattle in ground that is cleared.

The passage into St John's harbour, which in shape very much resembles a man's foot, is by a narrow entrance, called The Narrows, which extends nearly east and west about half a mile. Both sides of this entrance are high, abrupt, and rocky. The rocks are the same on each side,

being continued across from the one to the other. I think there is little doubt that the opposite sides of the Narrows had once been joined. A rapid river runs into the harbour. The harbour itself, previous to the formation of the Narrows, may have been a lake. The river appears to have been once much larger. By the action of the sea withont, and of the river and lake within, the rent or chasm by which the river formerly emptied itself into the sea, may have been gradually enlarged, till it has attained its present size. The average width may be two or three hundred yards. Quidi Vidi (pronounced *Kitty-vitty*) River and Lake may one day present an entrance and harbour similar to those of St John's.

The mineralogy of the country round St John's is very simple. The first rock, on entering the Narrows, is trap-tuff. This rock is distinctly stratified, each stratum generally measuring two or three feet in thickness. The strata lie NE. and SW., or rather NE. by N. and SW. by S. The dip is to the NW., at an angle of from 70° to 80°. The basis of this rock consists chiefly of distinct grains of quartz, felspar, and a red claystone. The imbedded minerals or pebbles are, for the most part, of the same substances; felspar, common and compact, the latter with small imbedded grains of quartz; quartz, often of a slaty or fibrous structure; jasper, red claystone, bloodstone, hornstone, &c. These imbedded minerals, at the foot of the hill or cliff (particularly the quartz and felspar), are generally from an inch to three inches in diameter, and gradually decrease as we ascend; at the top of the hill, they rarely exceed the fourth part of an inch in diameter. Does not this fact countenance the mechanical deposition of the trap-tuff? This rock appears much harder than the common varieties of the trap-tuff which I have seen.

It is this rock which forms those precipitous cliffs on

either side of *the mouth* of the Narrows. The opposite sides of the Narrows rise very rapidly from the sea to a considerable height. The highest part of the trap-tuff formation is about 300 feet above the sea; its thickness about 500 yards. The trap-tuff passes very gradually, and most beautifully, into the next rock, which is amygdaloid. In this passage of the one rock into the other, the stratified structure is still retained, one stripe or narrow stratum being distinctly marked trap-tuff, the next amygdaloid; the stripes of the former being broadest at first, gradually becoming narrower and less defined, till the amygdaloidal rock entirely prevails.

The strata of the amygdaloid also run in the direction of NE. by N. and SW. by S., and dip likewise to the NW. at an angle of about 65°. The basis of this rock, like that of the trap-tuff, consists of minute grains of quartz, felspar, and claystone. The imbedded portions are invariably of a red, smooth, hard claystone: they seldom have the amygdaloidal form, but are square or rhomboidal, or in longish slates. The greater part of the amygdaloidal rock is entirely destitute of these portions, while, on the other hand, more than one half of some of the strata is composed of them. The amygdaloid is frequently distinctly stratified, each stratum being a few feet thick.

The trap-tuff and amygdaloid are both of a reddish colour; the latter, however, sometimes occurs of a grey colour. The greatest height of the amygdaloid formation is 500 feet *; its thickness is about three or four hundred yards, extending from the top of Signal Hill to the foot of the Crow's Nest.

Resting upon the amygdaloid is found the greenstone,

* This is the height of Signal Hill, the highest part of the formation.

lower in height than the amygdaloid, but higher than the trap-tuff. This rock extends from the foot of the Crow's Nest (it being of greenstone) to the foot of the Signal Hill, or to the town of St John's, a thickness of six or seven hundred yards. The Crow's Nest, on which is built a small fort, is four hundred feet above the level of the sea. The principal constituent part of this rock is apparently felspar. Its most common colour is green, though sometimes grey and red; it is stratified, and sometimes possesses a beautiful slaty structure. The strata of the greenstone also run NE. and SW.; their dip is to the NW., at a much smaller angle than the preceding rock, the inclination not exceeding 50°.

Resting upon the greenstone we find the next rock claystone, the strata of which have the same direction and dip as the others, the angle of inclination, however, not being above 35° or 40°. The claystone formation extends two miles in thickness beyond the greenstone, occasionally alternating with strata of compact felspar, each stratum measuring from half a foot to a foot in thickness. The claystone being much softer than the rocks before described, the country where it prevails is also much lower. The town of St John's is built upon the claystone. In colour, it is most frequently grey, often also brown, dark-brown, red, whitish, and of other colours. It is often beautifully striped. It is fine-grained, smooth, and often conchoidal in the fracture. The strata of this rock are occasionally columnar, which is also sometimes the case with the greenstone; and the columns are composed of round concentric balls.

The next rock, whose direction, dip, and inclination are the same as those of the claystone, is compact felspar. This rock first alternates with the claystone, and then prevails alone for above a mile. Being harder than the claystone, the country composed of it is higher. Its colour is also

various, light and dark grey, greenish-grey, green, blue, &c. It is translucent, or slightly translucent, on the edges, while the claystone is perfectly opaque. The compact felspar has a splintery conchoidal fracture; the fracture of the claystone, on the other hand, is even, and always smooth. The compact felspar is more or less fine in the grain, and the splinters more or less large. The strata of the compact felspar, like those of the greenstone and claystone, are also at times columnar, the columns being composed of small round concentric balls, and very brittle. These balls are at times partially composed of hornstone. This mineral occurs also in the compact felspar, in thin beds, in veins, and in masses: its colour is green, its fracture smooth, conchoidal, it is slightly translucent on the edges, and is as hard as quartz.

Claystone again succeeds the compact felspar, and the latter is again succeeded by the former, thus alternating for about eight or ten miles across the peninsula. The claystone always possesses a slaty structure, and soon decays. The soil over the greenstone and amygdaloid is rich and good, while over the claystone and compact felspar it is light and poor.

XI.—*Observations on the Snowy Owl,* (Strix Nyctea, *Linn.*)

By Laurence Edmondston, Esq.

(*Read 23d March* 1822.)

The Snowy Owl was long known to be a native of the northern countries of Europe, but it has only more recently been ascertained to be a British bird.

I fell in with this species in Zetland, first in 1811; and, the following spring, I shot an adult male, which I shortly after presented to the proprietor of the Piccadilly Museum, Mr Bullock, at the same time communicating to him some facts regarding its habits which had come under my observation. That gentleman soon after published an account of this species in the Transactions of the Linnean Society of London; and since that period, it has, of course, been considered as a British bird.

Its Zetland name is *Catyogle*, which is indeed the general appellation given indiscriminately to all owls in that country, and it occurs chiefly in the Island of Unst, the most northerly of the group; but even there it is extremely rare, and very local, attaching itself only to two or three

districts of the island. The specimen now exhibited to the Society, which I have lately procured from that quarter of the country, was killed in December last. It is a female: the ovaria were very large, and well marked. It was altogether an uncommonly muscular and robust bird.

The external appearance of this species has been well described by ornithological writers: for this, I shall therefore refer to them; and shall only observe, that the plumage of this particular individual is singularly rich and beautiful. The dusky spots are more numerous than usual, which I am disposed to attribute rather to the circumstance of this bird not being arrived at permanent plumage, than to peculiarity of sex. The extent between the wings was five feet five inches; and the bird weighed five pounds, which is much beyond what has been commonly stated to be the weight of this species; but I suspect that, in the large owl, as in the eagle tribe, the females are larger than the males. Though, as has been alleged by ornithologists, it may be more active and alert during the day than other congenerous species, especially when it is once alarmed, yet I have never remarked it seeking for its prey but towards evening.

It rests generally beneath some stony projection, which protects it from the direct influence of the sun; and some instances have occurred of its being surprised asleep during the day, and forfeiting its life to its supineness.

Its form and manner are highly elegant; its flight less buoyant, and more rapid, than that of the other owls; and the superior boldness and activity of its disposition, the uncommon size of its talons, and vigour of its limbs, secure it against danger from feathered enemies.

It affects solitary, stony, and elevated districts, which, by the similarity to it in colour of the rocks, render it diffi-

cult to be discovered, and by the inequalities of their surface afford it shelter from the rays of the sun; but on the approach of twilight, it may be seen perching on the exposed eminences. It then quits its haunts, and frequents the cultivated fields, prowling over the low grounds in quest of mice and small birds. When first observed to leave its retreat, it is frequently assailed by crows and other birds; but it receives their attacks rather as an amusement than an annoyance, and dashes through the air despising their hostility.

It preys chiefly on sandpipers, on which it pounces with precision and agility as it skims along the marshes. The specimen given to Mr Bullock's Museum, had an entire one in its stomach when I shot it; and a mouse perfectly whole was taken from that of the present specimen.

I may here remark, that the stomach appears to be peculiarly small, and less membranous than what occurs in other carnivorous birds, and the food seems to be swallowed entire;—indeed, its bill being feathered to its point, renders this almost necessary.

When wounded or irritated, it hoots very vehemently, shaking its feathers, and striking rapidly with its feet; but otherwise, it appears to be as silent as it is recluse. And those screams, which Pennant describes as adding horror even to the desolate polar wastes, though a fine feature of wild sublimity, yet seem wanting to the scenery of Zetland,—this robust arctic warbler perhaps reserving his melodious powers for the icy solitudes of his favourite regions.

From the secluded nature of its retreats, its great rarity, and the superstitious aversion in which it is held by the islanders, who regard it a bird of ill omen, it is not surprising that its breeding-place in Zetland is so obscure. I have never heard of its nest having been found either there or in Orkney,—though, from meeting with it at all seasons, and

from its constantly, during the summer, frequenting the same situations, in perfect plumage and well developed sex, it is reasonable perhaps to conclude that it breeds in Zetland. Indeed I remember an intelligent peasant of Unst, whose veracity and accurate acquaintance with his native birds I had occasion to be satisfied with, assuring me of his once having met, in the month of August, with a pair of this species, having along with them two others, which he termed their young. One of these latter he shot; but unfortunately I was not aware of the circumstance till the specimen was destroyed. He described it as of the same size as the Snowy Owl; indeed, in every respect the same, but of much darker plumage; and this is all precisely what we should expect, on the supposition of this species breeding in Zetland.

A new and elegant species is thus added to the list of British birds; and a future opportunity may enable me to communicate some details, of which the peculiar facilities for ornithological pursuit of the Zetland Islands have put me in possession, illustrating the habits, and defining more accurately other genera and species of a class of animals so interesting to the naturalist, so generally diffused, yet still too often so obscurely known.

Edinburgh,
9th February 1822.

XII.—*Meteorological and Hydrographical Notes.*

By Capt. R. Wauchope, R. N.

In a Letter to Professor Jameson.

(*Read 15th December* 1821.)

Although the temperature of the waters of the ocean is a highly curious and important subject, it is not, I believe, many years since it claimed the attention of navigators. I have frequently experienced the utility of noting its changes, and have no doubt the same has been felt by many others. As you are collecting observations on this subject, and expressed a wish to know the results of some of my observations, I now send you the following Table, *viz.* of those made on the surface-water of the sea between St Helena and England.

The observations were made at three different periods of the day, *viz.* at 8 A. M. noon, and 8 P. M.

1. *Table, shewing the Relative Temperature of the Surface-water of the Ocean and the Atmosphere, between the Island of St Helena and England.*

Lat.	Long. W.	8 A. M.		Noon.		8 P. M.		October 1819.	Set of the Current on each day.
		A.	W.	A.	W.	A.	W.		
15° 6′ 0″ S.	6° 30′	-	-	-	-	65½	67½	4	N. 52 W. 7 miles.
13 35 0	8 5	68	67	74½	67½	67½	67½	5	Do.
12 43 0	9 24	70¾	69	71	69½	68	70	6	N. 71, W. 9½.
11 46 0	10 35	71¼	70½	77½	71½	71	72	7	N. 85, W. 16.
11 21 0	10 52	74	72	81½	75½	71	72	8	N. by W. 6.*
10 2 0	12 0	72¾	72½	73	73¾	72½	73	9	N. 10.
8 46 0	13 49	74	73	74	74	73½	74	10	S. 25, W. 13.
Anchor at Ascension.		74½	73½	-	-	-	-	11	On shore to-day. Ther. 81° in the shade at noon.
6 45 0	15 37	74	74½	74¾	75	74	76	12	S. 51, W. 6½.
5 28 0	16 41	75	75	78	76	74	76	13	S. 21, E. 14.
4 3 0	17 48	77½	76	79½	77	75½	77	14	S. 11, E. 5.
1 59 0	18 27	78½	77	78	77½	77	77	15	West 10′.
0 0 32 N.	18 49	77½	76½	79	76¾	77	77½	16	S. 52, E. 9.
1 44 0	18 40	78	78	78½	78½	76	78½	17	S. 22, E. 5.
2 47 0	18 42	74½	78½	77	78¾	75	79	18	S. 12, E. 17.
3 36 0	18 21	78½	79½	80½	80½	77½	79½	19	S. 12, E. 17.
4 39 0	18 39	77½	80	82	81	77½	81	20	East 12.
5 0 0	18 37	78½	80	78	80½	75	80	21	N. 56, E. 10.
5 37 0	18 44	79¼	80	80	81½	78	80½	22	East 10.
5 58 0	18 40	80	80	82	82	78	80½	23	N. 72, E. 13.
6 43 0	19 2	80	80	82	81¾	78	81	24	East 6.
7 8 0	19 13	80	81	82	81¾	78	81½	25	N. 56, E. 6.
7 28 0	19 4	80	80¾	83	83½	79	81	26	East 9.
8 21 0	20 0	79	80¾	80¾	81	79	80¼	27	S. 68, E. 19.
10 24 0	21 49	80	80	80¼	80	72	79¼	28	N. 86, W. 12′.
12 3 0	23 52	78	78½	78	78½	77	78	29	N. 60, W. 8.
13 19 0	25 53	77¾	77¾	78	78	76	76¼	30	S. 72, E. 9.
14 41 0	27 22	76½	77	77¾	76	76¾	77	31	N. 69, W. 8.
16 31 0	28 42	76	76½	76	76½	74½	76	Nov. 1	S. 84, W. 9.
17 59 0	30 30	74¾	76	75½	76	73	75½	2	S. 52, W. 10.
20 2 0	32 15	73½	75	74	75½	72¾	75	3	No current.
22 19 0	33 15	73	74½	73¾	75¼	72½	75	4	S. 84, W. 9.
24 0 0	34 0	74	74	74	74¾	72	75	5	No current.
25 14 0	33 44	74¾	74	76½	74¾	73	73¾	6	No current.
26 7 0	32 59	71¾	74	68½	73½	69½	73½	7	No current.
27 5 0	32 6	67¾	73½	69¼	73¼	68½	73½	8	East 9.
27 52 0	33 56	67¾	72¾	68½	73	65	72½	9	No current.
28 4 0	34 4	66½	72¾	73	73	69	68¼	10	S. 72, W. 11.
28 18 0	33 49	69	72	72½	72½	70	71½	11	S. 16, W. 7.

* Current tried in a boat.

Table continued.

Lat.	Long. W.	8 A. M. A.	8 A. M. W.	Noon. A.	Noon. W.	8 P. M. A.	8 P. M. W.	Nov. 1819.	Set of the Current on each day.
30° 7′ 0″ N.	33 8	71½	69½	71½	71¼	69½	69½	12	S. 59, W. 8.
33 34 0	32 8	69	69	70¾	70	66	65½	13	West 20′.
36 52 0	31 9	65	63½	67½	65	62½	62¼	14	West 11′.
— — -	- -	62	63	63	62	61	61¼	15	West 4.
41 42 0	27 86	60	61	63	60½	60	60	16	None.
42 46 0	24 37	59½	60	61	60	58½	60½	17	N. 45, W. 3½.
43 48 0	21 26	57	58	56½	57	56	57	18	Do. do.
44 55 0	18 20	55½	56¾	57½	56	55½	57	19	Do. do.
45 29 0	15 42	53¾	55½	54	54¾	55	55¼	20	No observation.
46 42 0	10 26	51½	54½	-	-	51	54½	21	
48 12 0	7 35	52¾	52½	51½	51½	48	52½	22	
49 28 0	5 16	44½	51½	43½	51¾	-	-	23, 24	Midnight. Eddistone light in sight.

In the foregoing table, the Thermometer merely marks the temperature of the atmosphere, and of the water at the surface.

I shall state some of the advantages which may be derived from keeping an account of this kind.

1. It may be the means of determining the various situations of banks or shoals in the ocean; for where the bank approaches the surface within 140 fathoms, the temperature upon it will be found to fall very considerably below that of the surrounding water.

Upon the 18th January 1819, upon approaching the Continent of South America, at 8 A. M., I found the temperature of the water to be 74¾ degrees; and as the thermometer stood the night before at 80°, I immediately hove to, and sounded, and got bottom in 100 fathoms, Lat. 22° 31′ S., Long. 40° 31′ W. The thermometer in this instance had altered 5¼ degrees.

Again, on the 9th April 1819, on approaching the Cape of Good Hope, from St Helena, at noon, the thermometer stood at 65° at the surface of the water; at half-past 2

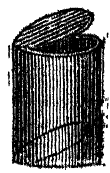
P. M. the same; at half-past 3 it stood at 62°. I hove to, and got bottom in 145 fathoms; Cape Point SE., Lion's Head NE. Here the difference was only 3°, and the water was 45 fathoms deeper than in the former experiment.

On coming into soundings in the English Channel, I found 5° difference of temperature.

If there are banks in the ocean which approach as near to the surface as 140 fathoms, they will be indicated by the fall of the thermometer in the surface-water; and all navigators will immediately perceive the advantage of determining their latitudes and longitudes by means of such banks, as from them ships may frequently be enabled to ascertain their situations with as much certainty as from land.

2. *Temperature of the Ocean at great depths.*

The following experiment was made to determine the temperature of the ocean at a considerable depth. The thermometer was inclosed in the middle of six cases, all of tin, except the outer one, which was of wood; each case had a valve below and at top, both opening upwards, in this manner; the valves remaining open when descending, but closing when coming up. The four inside cases were separated from each other about a quarter of an inch all round, allowing the water to pass freely between them.



The fifth case was distant from the one immediately inside of it about half an inch, and the space between filled up with *tallow*. The outer case of all, or sixth case, was of wood,

of an inch thick, and separated about an inch from the fifth case by a column of water. The size of the machine altogether was about two feet high, and ten inches in diameter. To the bottom of the machine was fastened a weight of 72 pounds, and to the upper part the end of a coil of two-inch rope. I first veered 779 fathoms of two-inch rope overboard, then 390 fathoms of two and a half, then 266 fathoms of three-inch, making in all 1435 fathoms of rope.

I had attached a thirty-two-pound shot to every 200 fathoms. It took twenty-two minutes to veer the whole overboard; and the apparatus was allowed to remain, after the whole was veered out, twelve minutes, before we commenced hauling it in, that the whole might have time to sink. From the great friction, we found much difficulty in getting it on board again; it took a hundred men just one hour and twenty minutes to do so. The thermometer, when it came up, stood at 42°, and the temperature of the surface-water was 73°, making a difference of 31°. I should imagine that the thermometer here had sunk about 1000 fathoms: the line did not go down perpendicularly. I determined the perpendicular depth by taking the angle which the line made with the ship's bow, and calling the line veered out the hypothenuse of a right-angled triangle, (which would not be quite correct). I thus found the perpendicular depth to be 1100 fathoms: but as the line would form a curve, I think the perpendicular depth would be as near as possible about 1000 fathoms. A little breeze sprung up towards the end of our operations, and the ship rode to the sunk line precisely as if she had been at anchor.—This experiment was made on the coast of Africa, in Lat. 3° 26′ S., Long. 7° 59′ E.

3. *Effects of the Weather on the Barometer, at the Cape of Good Hope.*

The next remarks I mean to trouble you with, are some observations upon the weather, with the effects which this has upon the Barometer, at the Cape of Good Hope. The barometer, from being more observed and better understood, has, of late years, added much to the safety of navigation. I can state for myself, that when I have got acquainted with the range of the barometer in any country, it never has deceived me in its predictions. The utility, then, of ascertaining the range, and the way in which the different winds affect the barometer in different climates, becomes a matter of very high importance to the navigator. From remarks of this description, in a very short time a set of observations might be compiled for every port of the world, to accompany the barometer: and such remarks would, in many cases, prove of consequence to the safety of a ship.

The summer months, at the Cape, are counted from the middle of September to the middle of April. The prevailing winds during this time are from the south-east: this is always a dry wind here; but a degree or two, at sea, to the westward of this, I never saw this wind unaccompanied with rain and damp weather. I did not observe the range of the barometer during the months of December, January, and February, to exceed .29 parts of an inch, ranging from 30.14 to 29.85. During summer, when the barometer rises above 30 inches, with a SE. wind, it will always blow strong: when above 30 inches, with a westerly wind, it will be fine moderate weather. The rainy winds, at all seasons, are, the NE., NW., and SW.: this last is often a dry wind.

I insert two examples of the Barometer during summer; the first shews the state of the barometer during a SE. gale, and the next its state during the NE. and westerly winds.

I.

December 1817.	Time of day.	Wind.	Barom.	Therm.	State of the Weather during the SE. Wind.
5	8 P. M.	SE.	30,06	64	Strong breezes.
6	8 A. M.	SE.	30,10	67	Strong gale.
	Noon.	SE.	30,13	67	Very strong gale.
	8 P. M.	SE. SSE.	30,13	66	Very strong gale.
7	8 A. M.	SE.	30,14	71	Very heavy gale.
	Noon.	SSE. var.	30,12	67	Light airs, and fine.
8	Noon.	Do. do.	29,90	74	Moderate and fine weather.

II.

December 1817.	Time of day.	Barom.	Therm.	Wind.	State of the Weather during Northerly & Westerly Winds.
11	8 P. M.	29,97	69½	NNE.	Strong breezes, and squally, a little rain.
12	8 A. M.	29,95	63	NNW.	Moderate and cloudy.
	Noon.	29,93	63½	NNW.	Moderate and cloudy, with much and heavy rain.
	8 P. M.	29,93	64½	NW.	Heavy rain.
13	Noon.	30,04	62	WSW.	Moderate and fine weather.
14	Noon.	30,01	62	SW.	Light breezes, and fine.

The range of the barometer during the winter months, viz. from the middle of April to the middle of September, is much greater than during summer. The greatest range I have observed being .85 parts of an inch, from 30.30 to to 29.45. This last is by far the greatest depression I have observed, and this but once. I had never before seen it lower than 29.65, and then it blew very hard from NW. It may be laid down as a general rule in this climate, that whenever the barometer falls as low as 29.70, during the winter months, it will blow hard from NW. or NE.; when as low as 29.65, it will blow very hard; and when below

this, a heavy gale. The NE. wind is an uncommon wind at the Cape. I have seen moderate and light breezes from the NE. for twenty-four hours, but this is rare. A NW. or SW. gale sometimes commences with the wind NE., and it may blow very hard, with squals, for an hour or two, from this quarter; I think rarely longer than two hours. A ship ought to be prepared when this occurs, as the wind will most certainly fly round to the SW. or NW. at once. And whatever tack the ship might have been on before, she ought now to get upon the starboard tack; for after it has blown hard from the SW., and a heavy sea has got up (this wind raises the heaviest sea), it frequently flies round to the NW. suddenly; and it is those sudden shifts of wind which make the sea off the Cape of Good Hope so dangerous.

The following example shews the state of the Barometer during a heavy gale in winter. The quicksilver here fell as low as 29.45, which was lower by .20 of an inch than I had ever observed it before.

1819.	Time of day.	Wind.	Barom.	Therm.	State of the Weather.
May 31.	8 P. M.	SSE.	30,10	60	Light airs, and fine weather.
June 1	8 A. M.	NE.byN.	29,93	58	Mod. not blowing very strong.
	Noon.	NE.byN.	29,83	59½	Moderate weather.
	8 P. M.	N. by E.	29,66	62½	At 1½ A. M. very heavy squalls from NE.
June 2.	2½ A. M.	SW.	29,50	—	Blowing strong and squally. It had been blowing hard from NE. when we were taken aback from SW. a heavy gale.
	4 A. M.	WSW.	29,45	—	Blowing very hard; a heavy sea getting up.
	8 A. M.	WSW.	29,56	59½	Now that the quicksilver has begun to rise, the squalls are heavier than ever, with rain, but do not last so long.
	10 A. M.	W. by S.	29,70		
	Noon.	W.	29,71	59¼	Still blowing strong,
	1¼ P. M.	Do.	29,79	—	And squally, but more mod.
	2 P. M.	Do.	29,81	—	Sun out; at times much more moderate. Heavy sea.
	4 P. M.	Do.	29,90	—	Moderate, with much sea.
	6 P. M.	Do.	30,00	60	Moderate and clear; light winds at times.

Remarks.—At sunset, on the 1st of June, the wind was so moderate, and the weather looked so fine, that I was almost tempted to believe we should not have any very bad weather; however, the mercury still continuing to fall, induced me to close-reef the topsails, and get top-gallant yards on deck. At 8 P. M. there was no appearance of a gale, but the mercury still falling, I got top-gallant masts on deck, and all the storm-sails bent, and every thing prepared for a gale. About 1 A. M. the gale commenced, blowing very hard in squalls from the NE. We were on the starboard-tack, and quite prepared for being taken a-back with the wind from the SW., which happened accordingly at half-past 2. The wind came after this very steadily from the W. by S. and W., blowing exceedingly hard, with very heavy squalls. We found it here, and I have in general observed it to be the case, that, just at the time when the mercury begins to rise, the squalls increase in violence, but do not last so long. From noon of the 2d, till 4 P. M., I think the sea was heaviest, very irregular, and breaking exceedingly: some of the seas broke so much as to have the appearance of high breakers. It went down, however, very fast, and at 8 P. M. there was not much sea. Had we been to southward and eastward of the Cape, we should have had a much heavier sea, in consequence of the currents being stronger there. The strength of the currents here is very extraordinary, and it will appear the more so, when it is mentioned that they are strongest during a NW. gale, which blows exactly in the opposite direction to them. On the 7th January 1818, I was set to the westward against a strong NW. gale 70 miles during the first 24 hours, and 63 miles during the next. With a SE. wind, I never observed the current very strong off the Cape.

The predominating colour of the clouds during those westerly gales is a very light soot colour, in large rounded

masses, over a pale brass-coloured ground; as the gale breaks, the clouds assume a darker colour. The sky invariably assumes this pale brass-colour before the gale comes on. An old pilot, who had been upon this coast for thirty years, first mentioned this to me: he said, whenever he saw the sky have that brassy-like appearance, and those *double-headed clouds*, he was sure that a westerly gale was coming on. What he meant by his double-headed clouds, were those rounded masses I mentioned above: they are of different shades; the light-coloured are highest, and they shew out from under the darker ones, giving just that appearance which is best expressed by *double-headed.*

I have been thus particular about the weather here, to shew the very great advantage which may be derived from the study of the barometer; for had I not been prepared before the gale came on, I most certainly should have lost my masts, and most likely the ship and our lives; for on our arrival at St Helena, we found our foremast so rotten, that it was a wonder, after all our precaution, how it stood during the gale.

4. *On Under-Currents.*

I have only a very few remarks to make respecting the under-currents. That there are under-currents in the ocean, I ascertained in the following manner. After having moored the boat in the usual manner, I lowered a very large white flag down a few fathoms below the surface, and was surprised to see it carried out by a current in an opposite direction to the current which was running on the surface. In Lat. 32° 38′ S. Long. 13° 45′ W. the current on the surface set E. by S. 7 miles; at 10 fa-

thoms, the flag was carried out NE. by N.; at 15 fathoms, the same. I tried this experiment again the same day, and found the surface-current to set E. by S. 7 miles; at 10 fathoms, E. ½ N.: at 13 fathoms, NE. ¼ E.; at 15 fathoms, the same. Again, in Lat. 30° 33′ S. Long. 13° 40′ W. current on surface E. by S. 14 miles; at 10 fathoms, NE. by E.

5. *Range of the Barometer at St Helena.*

At St Helena, during the many months which I had an opportunity of observing the barometer there, I never have found it range more than .45 parts of an inch: the two extremes are 30.25 and 29.80. The usual height is from 30 to 30.10. The wind here varies very much with respect to its strength, but seldom above a few points in its direction. It seems to be affected a good deal by the moon; for I have always observed, and had my observations confirmed by all the ships on the station, that, at or near full moon, there are light winds; and at the first and last quarter it blows strongest. At all times, it blows stronger about noon than at any other time of the day.

6. *On the Phosphorescence of the Sea.*

I shall only mention one observation, which induces me to believe, that, in some cases at least, the shining appearance observed frequently during the night in the ocean, is occasioned by phosphorescent animalcula. In September 1816, in Lat. 4° 52′ S. Long. 9° 19′ E., I ob-

served this shining appearance very strongly, which induced me to draw a bucket of water, for the purpose of examining it. I had it suspended so as to have as little motion as possible; when this was the case, it shone very little; but the moment it was disturbed, it shone with great beauty. I next got a little lime-juice, and put a wine-glass full of this acid into the bucket, when the shining particles began to move about in all directions, sometimes going only as far as the middle of the bucket, then turning and taking a zig-zag direction. These motions certainly had every appearance of the depending upon the will of an animal: they shone with much splendour, and some appeared as large as the tip of one's finger. Another glass of lime-juice instantly destroyed them; for, at the instant the second quantity was poured in, the water appeared to be one blaze of fire, and no motion or disturbance could make it shine after this.

I then drew some more water up, which shone as before; part of this I kept during the night in an open vessel, and part tightly corked up in a bottle; and the next night, on examining these two portions, I found that the water in the open vessel shone pretty brightly, but not so bright as it did; and that which had been corked up did not shine in the least, the want of air seeming to have killed the animals. They appear to me to be coated with some phosphorescent matter; for one of them I happened to rub upon my fore-finger, which left a streak of light for a few seconds, as long as the first joint of my finger. Now, when the fire-fly, or the glow-worm, are killed, their light is immediately extinguished.

XIII.—*Account of the Small District of Primitive Rocks, near Stromness, in the Orkney Islands.*

By Mr GEORGE ANDERSON of Inverness.

In a Letter to Professor JAMESON.

(*Read 17th November* 1821.)

DEAR SIR,

THE point on which I have taken the liberty of addressing you at present is not of any great importance, but I think you will still consider it worthy of notice. It refers to the extent of the Primitive District in the Orkneys.

From the notes I had taken from your Lectures, and, if I recollect well, from your Mineralogical Travels, I was led to expect that this district was only one or two miles in length, by half as much in breadth. While examining it, however, along with my friend Mr CHARLES CLOUSTON, with whom I spent some weeks this last summer, I found that the longitudinal direction of the primitive strata lies

from SE. to NW., commencing with the harbour of Stromness, and running through the high hill above that town to a place called Yeskanaby, on the west coast of Pomona, two miles on this side of the house of Skail. Here it terminates in a high mural precipice overhanging the sea, and, to the north, is immediately succeeded by the common greywacke-slate, and by a greyish sandstone, which, from its hardness and crystalline texture, is the only stone of that kind used for mill-stones in the whole island. Perhaps its vicinity to the strata of primitive gneiss may have given it these superior qualities.

From this point of Yeskanaby we traced the gneiss (which is of the common grey kind, traversed by numerous veins of felspar and quartz) in a continuous and uninterrupted line back all the way to Stromness, and thus found its greatest length to be from six to eight miles.

Its utmost breadth lies between the Island of Græmsay, which is partly formed of gneiss, and the Bridge of Wae, where the road crosses Loch Stennis, in the direction of Kirkwall. I also thought that this breadth might be still greater, from an expectation that gneiss formed the fundamental rock of Hoy, founded on a report that gneiss or granite had been seen near Rackwick, on the south-western side of this latter island. Of this, however, we could observe no confirmation, but noticed at the same spot a large bed of greenstone among the strata of red sandstone. The lateral extent of the gneiss, therefore, does not exceed two or three, or at the utmost four, miles; and even this, as we approach its northern extremity, near Skail, gradually tapers to 100 or 200 yards.

From having thus traced the boundaries of the primitive district in the Orkneys, we may presume that no strata of that class will be found in the Island of Pomona, or Mainland of Orkney, to the north of Yeskanaby or Skail; for

we saw the gneiss evidently running out at this point under the waves of the Atlantic Ocean. From the same circumstance, we may also remark, that here, as in other parts of this kingdom, the primitive and highest lands are on the west; and further, that the gneiss in Pomona appears in the form of a nucleus, round which, or towards which, the secondary strata uniformly tend.

I am, &c.

Inverness,
27th October 1821.

XIV.—*Account of a New Species of Larus, shot in Zetland.*

By Laurence Edmondston, Esq.

(*Read 24th March* 1821.)

In no department of Ornithology have obscurity and error been more conspicuous than in what relates to the Gull tribe. Although widely diffused—of roaming and migratory habits—of striking and interesting peculiarities of instinct—and comparative familiarity of disposition, many of the species of this genus of birds have been long indistinctly characterised; and some are yet hardly known to naturalists.

The young, of all the species of gull of which we have any accurate account, differ from the parent-birds in their plumage, and frequently in their modes of life; and the different species approach each other often by such nice gradations, that, without a continued and intimate acquaintance with their varied appearances in their native regions, or the possession of that practical tact in detecting specific differences, which such an acquaintance is best calculated to confer, a mere examination of the external characters

and anatomical structure of any particular individual, or a transient observation of its habits, will often be found inadequate to determine its specific rank. For example, the Lesser was long confounded with the Greater Black-backed Gull, and the young of the *Parasiticus* described and figured as a distinct species.

The rare and very interesting species of gull which forms the subject of this paper, seems, till lately, to have eluded the observation of ornithologists, and, inhabiting and visiting only remote regions, to have been known only to their rude inhabitants. But although I have myself observed it on the shores of the Baltic, and on the coasts of the German Ocean, it is to its occurrence in the Shetland Islands that my present observations are exclusively confined. In that country, possessed of so many rare facilities for the investigation of its zoological objects, I first became aware of the existence of this species, by accidentally shooting an individual of it, in the autumn of the year 1809. The singularity of its appearance attracted my attention; and though then but a novice in ornithology, and diffident in indulging the hope of discovering a new species, in a tribe of birds so prominently exposed to the view of naturalists, yet my curiosity was awakened, and my exertions to procure accurate information of its history and habits became indefatigable. That specimen was, unfortunately, soon destroyed; but, in 1814, I procured another, which I immediately afterwards presented to Mr Bullock, for his Museum in Piccadilly, and it continued to be exhibited there till the dispersion of that valuable collection. Its description is the following. Length two feet nine inches, breadth five feet four inches, irides silver-grey, and the feet flesh-coloured. The general colour of the body ash, with a slight shade of brown; darkest on the back, where, on some of the feathers, a faint tinge of blue might be per-

ceived; the head streaked a little with grey; the rump and vent irregularly barred with pale-brown, and the *primary* and secondary quills dull *white;* the bill nearly of the same length as that of the Greater Black-backed Gull, but more slender, and less hooked. The tail consisted of twelve feathers, of a bluish-grey colour, some of which were faintly and irregularly barred with dull white. In weight, this species is little inferior to the *Larus marinus,* and occasionally it occurs even of a greater size.

The specimen which I have now the honour of submitting to the examination of the Society, differs in no important respect from the individual above described. Its size is rather smaller; but this was obviously owing, chiefly to the unusual leanness of the bird when it was killed, and to the subsequent shrinking during its preservation. Its plumage, generally, is darker; the brown spots and bars occurring on the wing-coverts, and on some other parts of the body, better defined, and the irides dark-brown; but these varieties are at once accounted for, on the supposition of its being a younger bird. From this consideration, I have preferred giving here the description of the specimen sent to London, to that of the present one; and also from its affording a more accurate representation of the general appearance and size of this bird, as met with in the Zetland Islands.

This species is never known to breed in Zetland. It arrives in that country about the middle of autumn, and leaves it toward the end of spring; and this migration appears to be completely general, at least, I do not remember seeing one during the whole summer season. In this respect it totally differs from all those species of known Gull, to which, on a superficial view, it might be supposed to approximate.

Its favourite resorts are the entrances of the more expos-

ed bays; or the ocean, a few miles off the land, where it is often found assiduously attending the fishing-boats, to pick up any offals that may be thrown overboard; and it is often taken by a line and hook baited with fish, when engaged in this pursuit.

It is greedy and voracious to a proverb; and when allured by carrion, which seems to be its favourite food, becomes comparatively indifferent to danger. It then quits the ocean and the headlands, enters the bays, and boldly ventures inland.

Generally speaking, it is rare; and I have hardly above once seen more than three or four individuals at one time. Occasionally a single bird may be met with, attending a large flock of its congeners, and feeding along with them. Upon these occasions its peculiarity of appearance is very striking.

Its usual deportment is grave and silent, exhibiting little of the characteristic vivacity or inquisitiveness of many of its tribe, and it is roused to exertion chiefly by a sense of danger, or the cravings of hunger.

When it flies, it extends its wings more than the other species of Gull, and its flight is also more buoyant. And when not in quest of food, it is of a reserved disposition, and seldom comes within the range of a fowling-piece, but soars at a respectful distance, uttering, at intervals, a hoarse scream, of a sound quite peculiar to itself.

It exhibits none of that remarkable instinct so predominant in many species of the genus, which prompts them frequently, at the hazard of their own lives, to warn other animals of the vicinity of the sportsman; but when once alarmed, it commonly flies off.

Independently of considering this bird as a new species, I had all along been induced to regard it as in an imperfect stage of plumage, having observed a considerable diversity

of colour amongst several individuals which I had an opportunity of examining,—some being darker, and others lighter, than the specimen I have described,—and the colour of the iris presenting a corresponding variation, from dark-brown to silver-grey. These changes are perfectly analogous to what occurs in the young of the greater part of the genus, and hence I was led to the conclusion of the present specimen being a young bird. But as, in those species to which this resemblance applies, the iris attains its permanent colour some time before the perfect plumage is assumed, I could only form a vague conjecture of its adult appearance. Fortunately, however, in the same flock, from which I killed the specimen above described, was a considerable number of individuals of this species, in what I decidedly consider maturity of plumage. In general appearance and habits, no difference could be detected. The back and upper part of the wings were light-blue, passing into white. All the rest of the body, and the primary and secondary quills, dull-white.

In the month of November last year, I observed a flock of upwards of a hundred of this species in the Bay of Balta Sound, in Shetland. They remained there for two or three weeks, going out to sea, in search of food, regularly at a particular period of the tide, and returning to rest for some time in the Bay. During this time I had ample opportunities of observing their appearances and habits, and of completely confirming all the views I had previously entertained concerning them. Unfortunately I could not at that time procure an adult specimen, from the want of sufficiently heavy shot, the peculiarly thick-set plumage resisting, at any considerable distance, the effect of the smaller sizes, which could then alone be procured in that distant quarter of the country.

It is in Unst, the most northerly island of the group,

that I have found it most frequently, and where it is chiefly known. It is there that I have observed it first to arrive; and this most generally occurred when the wind was favourable from the Arctic regions.

In stating the claims of this bird to specific distinction, the circumstance will not be overlooked, of its being regarded by the Shetland fishermen as a distinct species. Such an opinion is not to be considered as wholly unimportant; for, unbiassed, in this instance, by prejudice or selfishness,—possessing the most select opportunities of accurate observations on the more palpable and distinguishing peculiarities of those birds which their country supplies,—their attention, from their modes of life, naturally directed to those observations,—and they being acute, and perfectly competent to arrive at just conclusions in connection with them,—their testimony may be considered, at least, a strong presumption, in support of the pretensions of this bird to distinction of species. Indeed, I have seldom found their sagacity fail in accurately marking such specific boundaries; and, in this instance, in compliance with their conviction, they have distinguished this bird by the name of Iceland *Scorie*, (or the Young Iceland Gull); *Scorie* being the general Shetlandic appellation for the young of several species of the gull family.

Of the place of its breeding I know nothing. It is probable, I think, that it selects for this purpose the shores of Lapland and Norway, of the Faro Isles, and of Iceland. The name, indeed, given to it in Shetland, would seem to indicate that it is at least found in Iceland, although I have not been able to trace the origin of the appellation. The intercourse between that country and Shetland was formerly more frequent; and if it was observed to be numerous, or to breed there, it might naturally enough receive the name of Iceland Gull.

Additional Account of the Iceland Gull.

By Mr Laurence Edmondston.

(*Read 23d March* 1822.)

In February, last year, a paper was read to the Society, describing an interesting species of Gull, which I had first met with in the Zetland Islands in 1809, and which is known there by the name of Iceland Gull. A specimen was at the same time exhibited; and, though a young bird, and not arrived at mature plumage, it sufficiently displayed the more prominent external distinctions of its species.

I have since, however, been fortunate enough to procure an adult bird, which will more clearly confirm the opinion of its being a distinct species, and establish the accuracy of what I formerly suggested regarding it.

This specimen, which is now exhibited, and is submitted to the examination of the Society, weighed 5 pounds; its breadth, between the wings, was 5 feet 2 inches; the length, from the point of the bill to the tip of the tail, 2 feet 5 inches. The back and upper part of the wings pale-blue, head and neck streaked with grey. The upper part of the two middle tail-feathers ashy, but this appearance is quite accidental and unimportant; the rest of the plumage and the primary quills white; irides pale-yellow; the claws are dusky; the feet and legs much like those of the Herring Gull, but

considerably larger; the wings, however, proportionally shorter; the general shape of the body fuller, and less tapering; the neck is unusually thick and strong; its flight is more equal and measured, and has less of that kite-like soaring which others of its tribe affect. The bill is long and powerful, not so much hooked as that of the *Larus marinus;* and when the bird is alive, it is of a pale-yellow colour, with a patch of a deeper shade near the point of the lower mandible; its length is four inches.

This specimen was a very distinct male, and was shot in Balta Sound, Zetland, in November last (1821), out of a flock of two or three hundred of this species.

In some specimens that I have examined, in Zetland, hardly any grey was to be seen on the head or neck, and such I consider as in the more perfect and permanent plumage.

When I first described this species in 1814, I was not aware that any thing similar to it had been noticed by ornithological writers, the remote situation of Zetland being so little favourable for my consulting books on natural history. I have since, however, found species described, which, in some points, seem to agree with the Iceland Gull; but these descriptions are so brief and obscure, at least so far as my ornithological research has been carried, that little accurate or full information from them can be obtained.

It would be superfluous to repeat here what was detailed in the paper already referred to, regarding the habits of this bird. I might simply state, that the observations then made, have been since amply and satisfactorily confirmed.

I have especially remarked, in this species, the absence of that instinct so conspicuous and interesting in its congenerous birds most allied to it in size and general appearance, which renders them so hostile to the sportsman, by warning other animals of his approach. It

displays little of the activity or clamorous curiosity of many of its tribe; nor is it equally acute in detecting danger, though more uniformly reserved, and sufficiently cautious when its fears have been once excited.

The plumage is swan-like, very full; the down on the body considerable,—altogether rendering it almost impenetrable to any shot, but that of a large description. Of my previous knowledge of this circumstance, and of its characteristic partiality for carrion, I have successfully availed myself, to procure specimens, which otherwise would have been inaccessible to the fowling-piece.

It is generally observed to keep separate from other birds; and this fact is of itself a strong presumption of its distinction of species.

Its muscular vigour is peculiarly great, proportionally superior to that of the other gulls; and the power and execution of the bill are so formidable, as to compel one to be very circumspect in approaching it when wounded.

As in other species of this family of birds, individuals differ from each other in point of size; and, as far as I have observed, the male is larger than the female,—a remark which may perhaps be extended to other species of its tribe. From this difference chiefly, I was at one period disposed to believe that there occurred two species of Iceland Gull, having a relation to each other, analogous to that which exists between the Greater and Lesser Black-backed Gulls, and the *Larus fuscus* and *canus*; but subsequent observation is not so favourable to this opinion.

It is more perfectly an oceanic bird than perhaps any of the larger species of the genus; and from its habits might be regarded as forming, in some measure, a link between the more prominently defined Gulls and Petrels.

I have always observed this species to be uncommonly fat when it first arrives in Zetland, in autumn. Indeed, I

hardly remember ever seeing any bird equal to it in this respect,—a circumstance which, together with that of the singular compactness of its plumage, and voracious avidity for carrion, first induced me to suspect this marine vulture to be a native of the higher latitudes. This conjecture was confirmed by accidentally falling in, at London, with a specimen of this gull, brought home by the Arctic expedition under Captain Ross, which agreed with the description I had given some years before, of the adult Iceland Gull; with this trifling difference, that there were scarcely any grey streaks to be observed on the head or neck,—a difference which might, indeed, refer to age, or climate, or season, but certainly could not affect the identity of species.

If the opinions, then, which I have suggested regarding this gull be adopted, they will present to ornithologists, of a numerous and very interesting genus, a well-defined species, before obscurely known, assuredly undescribed, as a British bird, and may authorise the trivial name of *Larus Islandicus*, by which I have proposed to distinguish it, as expressive, both of its Arctic haunts, and of the vulgar appellation by which it is known in the Zetland Islands.

XV.—*Notice relative to two varieties of* Nuphar lutea, *found in a Lake in Aberdeenshire.*

By Mr W. MACGILLIVRAY.

(*Read 9th February* 1822.)

ONE of the plants which form the subject of this communication, was, in as far as I know, first observed by Mr GLENNIE, teacher of drawing in Aberdeen, in July 1819. Not having seen the *Nuphar lutea* before, Mr GLENNIE took his specimens for that plant in its common form. There existed, however, a considerable difference in point of magnitude, which induced me to suspect, on first seeing his specimens, that they were not the same. I accordingly proceeded to the lake, where, besides the variety found by him, I had the pleasure of finding another, much more remarkable.

The Corby Loch, situate about three miles to the north of Don Bridge, near Aberdeen, is a circular lake, about half a mile in diameter, with brown water, such as we commonly find on the muirland districts. It is in general shallow near the edge, and rather destitute of vegetation, hav-

ing merely the common species of *Potamogeton*, with *Litorella lacustris*, and *Myriophyllum spicatum;* but at the north and west parts, where it is deeper, there is abundance of *Scirpus lacustris*, *Arundo phragmites*, and other large aquatics, in the open places, between the tufts of which grows the beautiful *Nymphæa alba*, so rare on the east side of Scotland, and so very common in the Hebrides and West Highlands. On the north side of the lake are some patches of the plant found by Mr GLENNIE, while on the west side is abundance of another and more remarkable variety.

The two plants agree in possessing the following characters, which were noted from a considerable number of fresh specimens.

CALYX. Perianthium pentaphyllum, magnum, coloratum, foliolis obovato-rotundatis, concavis, patentibus.

COROLLA. Polypetala, minor; petalis patentissimis, cuneato-linearibus, erosis, dorso nectariferis.

STAMINA. Filamenta linearia, recurvata, quadruplici serie digesta, receptaculo inserta. Antheræ adnatæ.

PISTILLUM. Germen ovatum. Stylus brevis crassus. Stigma peltatum, elliptico-rotundatum, radiatum.

PERICARPIUM. Capsula corticosa, ovata, multilocularis, polysperma, (vix pulposa, hinc minime bacca vera).

SEMINA. Nitida . . . .

A person falling upon the two plants, at a distance from each other, would be ready to describe them as distinct species. He might thus imagine that three species existed in Scotland, whose essential characters might be as follow:

N. major, stigmate integerrimo elliptico.

N. media, stigmate repando sub-elliptico.

N. minor, stigmate dentato subrotundo.

In the true *Nuphar lutea*, or common form of the plant, the flowers are upwards of two inches in diameter; the lobes of the leaves are approximated, and even cross each other; the leaves are smooth, and their outline is regular, without sinuosity.

In the larger *Nuphar* of the Corby Loch, the flowers are generally about an inch and a half in diameter; the lobes of the leaves are also approximated; the back of the leaf is very slightly pubescent, especially on the lobes; the outline as in the last.

In the smaller *Nuphar* of the same lake, the flowers are not more than one inch across; the lobes of the leaves are widely separated; the outline is irregularly waved, or sub-angular, the lobes being distinctly angular; and on the back of the leaf there is a good deal of fine whitish pubescence, especially about the middle nerve, and on the lobes.

In the first, as has been said, the stigma is elliptical and entire; in the second, elliptical, but waved; in the third, rounded, and very distinctly dentate.

The difference between the common form of *Nuphar lutea*, and that of the larger variety of the Corby Loch, is not great, being observed chiefly in the size; and between the latter and the small variety, specimens occur of intermediate character. Hence, however different the common *N. lutea*, such as it is seen in the south of Scotland, and in the Island of North Uist, where it occurs in great perfection in the lakes near Loch Maddy, may appear from the diminutive *Nuphar* of the Corby Loch, it is probable that they form the two extremities of the same specific form.

The *N. minima* of SMITH I have not seen; but it is to be observed, that both it and the synonymous *N. kalmiana* of HOOKER, have precisely the character of the small variety of *N. lutea* mentioned above,—excepting in the case of the margin, which SMITH describes as green. The species of

Nuphar, therefore, require to be more accurately determined. As to the petioles, they can furnish no character, being two-edged in all; and the approximation of the lobes of the leaves is scarcely of importance; the same, of course, must be said of the vinous odour.

It may further be remarked, that the specific name *lutea* is not the most eligible, when there are two species to which it might be applied with equal propriety; and the seed-vessel is by no means a *berry*, being simply a thick capsule, with pulpy dissepiments, but having no gelatinous or pulpy mass in which the seeds are imbedded. The nectaries on the back of the petals have not been noticed, in as far as I know; and the stigma can scarcely be called sessile, when between it and the germen there intervenes a neck of considerable size.

Many of our plants exhibit variations similar to the above, even in their native situations. The *Polygonum viviparum*, for instance; and the *Thymus serpyllum* loses its aromatic smell on the summits of the Hebridian mountains. *Nymphæa alba* experiences occasionally a similar diminution in size; and I have seen the leaf not more than three inches in diameter, but in this case all the parts retain their original form. It will not be surprising if at least some of the localities of our Scottish *N. minima* be found to present a diminutive variety of *N. lutea*. The observations, however, which are to determine this point, can only be made by those who have it in their power to compare the varieties, by studying them in their native situation.

XVI.—*Geognostical Sketch of Part of the Great Glen of Scotland.*

By Mr George Anderson of Inverness.

(*Read* 12*th January* 1821.)

In this communication I propose to give a mineralogical sketch of part of the Great Glen of Scotland.

This extensive valley cuts across the Island in the direction of NE. and SW. from Inverness to Fort William, and thereby forms the boundary between the middle and northern divisions of Scotland. Its bosom is adorned and enriched by the Lochs Ness, Oich, and Lochy; and the alluvial depositions that cover its surface constitute the bed of the Caledonian Canal. Its utmost length, from sea to sea, may be about 62 miles; and although Inverness marks its termination on the eastern coast, still the ranges of mountains that bound its sides do not stop exactly at that point, but run on for several miles, on both sides of the Murray Frith.

As the geological description of these mountains forms a principal object in the present communication, we shall

trace them to their termination on the east, and then westward, to the central chains, at Fort Augustus.

Fortunately the view, from any of the heights above the town of Inverness, exactly embraces the whole circuit of these mountains, from their extremity on the NE. to that on the SW.; and it is, accordingly, to the objects included within this panoramic view, that I now intend to restrict my description. From these hills we observe, on the NE. side of the Frith, the entrance to the Bay of Cromarty; and passing the eye along towards the west, we find the coast skirted by a line of fine sweeping hills, whose course is interrupted at Kessock Ferry by part of the Beauly Frith. The same chain of hills is observed rising gently from the sea on the Inverness side of the Ferry, and, after forming the well-known Craig Phadric, we see them terminate, after a course of six miles, in the neighbourhood of Dochfour. At this point, which is at the lowest extremity of Loch Ness, we observe a change in the height, bearing, and outline of the mountains; and, with this change, which I shall afterwards shew to be both of physiognomy and composition, we can trace the continuation of the chain along the edge of the Loch, all the way to Fort Augustus. Here our view is bounded by the line of the horizon. Stopping, therefore, at this point, and then directing our eye to the south side of the valley, we discern a third range of mountains, running, opposite to the one we have just mentioned, by Boleskine and the Fall of Foyers, to Dores, a village situate at the lower extremity of this side of the Loch, and nearly opposite to the above mentioned point of Dochfour. Above this village another change takes place, both in the direction and character of the range; for, instead of pursuing their former course, in a line with the edge of the lake, the mountains deflect considerably towards the east, and, subsiding into a smooth

and low ridge, which I shall afterwards shew to be composed of transition-rocks, they fall into the low grounds between Fort George and Nairn.

Such are the ranges of hills seen from Inverness, and which are connected with that portion of the Great Glen we are about to describe.

By extending the sphere of vision, we might have included the ranges of Ben Nevis and Strath Connon in Ross-shire, and those of Strath Glass and Strath Nairn in Inverness-shire, but these have no connection with the mountains of the Great Glen.

According, then, to the above statement, we shall have to describe, in the circuit seen from Inverness, four distinct ranges of mountains. The first of these extends from the entrance to the Frith of Cromarty to Dochfour. The second, from Dochfour, or rather from a point (called Phopachy, to be afterwards noticed) behind it, to Fort Augustus; the third, from Fort Augustus to Dores; and the fourth, from Dores, by the Muir of Culloden, to Fort George.

After describing each of these in the above order, we shall conclude with a brief examination of the alluvial matters contained in the intervening valley.

First Range.—*From Cromarty to Dochfour.*

It may be observed at once of this range, that it is part of the great deposit of Red Sandstone, which has been so frequently described as skirting the whole of the east coast of Scotland, north of the Spey. Whether this red sandstone is to be considered of the same nature with that described as occupying so large a portion of the west coast, I am not able to determine, having never seen any of the

rocks of that quarter. I may, however, observe, that, as far as my observation extends, no clay-slate or greywacke, similar to those which occur in the red sandstone of Sky and Applecross, are found on this coast. Nor does the red sandstone of the range at present under our view, rest upon or alternate with gneiss, or any other of the primitive rocks, as it is said to do on the west coast, unless it be near Dochfour, where it approaches mountains of gneiss and granite. Its relations in this direction, however, I have not yet been able satisfactorily to explore. I may also remark, before commencing the particular description of this sandstone, that it is in one spot (near Fortrose) covered by a small portion of secondary strata, which, although I have not yet examined, I conceive to be a mere prolongation of the secondary deposits of Morayshire. The other points of resemblance between this red sandstone and that of the west coast, may be gathered from the following description.

The principal range, or rather ridge, which skirts along the Ross-shire coast, rises to the height of from 300 to 500 feet, and presents an outline in general waving, frequently tabular, and, in one or two instances, broken into short and sharp peaks. The bearing is uniformly towards the east or north-east, and the dip is towards the west, varying, however, in regard to the magnitude of its angle. A similar uniformity of dip and bearing pervades the whole of the mountainous chains in this district; and it will perhaps save us the constant repetition of the same northeasterly tendency, if we here, once for all, refer to the natural position of the Valley of the Ness.

Of the ridge here alluded to, the acclivities next the sea are frequently precipitous; but, as might be expected, from the direction of the dip, the slope towards the interior of the country is much more gentle. Red Sandstone, which

forms the whole of this ridge, constitutes also the whole of the peninsula called the Black Isle, lying between the Friths of Cromarty and Beauly, as also the land for a few miles round all the shores of this latter Frith. On the Inverness-shire side of Kessock Ferry, the remainder of the chain, to Dochfour, consisting of three or four hills, is formed of the same sandstone, and its associated conglomerate. The most conspicuous hill in this part is the beautiful and well-known Craig Phadric, on whose summit is situate the well-known vitrified fort. It gradually rises from the village of Clachnaharry, situate at the entrance of the Canal, to the height of 500 feet, and terminates in a tabular, or rather elliptical, summit, whose length is 220 feet, and breadth 100 feet. Towards Kessock, it subsides into two lower and mural tops; but its acclivities, towards Inverness and the Beauly Frith, are sloping, and highly cultivated. The highest top is surrounded by a wall of vitrified earth and stones. Where the masses are but partially vitrified *, we can discern them to be composed of the sandstone and conglomerate, which form the great body of the hill, as well as of boulders of granite, gneiss, felspar, and quartz rock.

To the west of Craig Phadric, the country, for many miles along the Beauly Frith, is composed of the same red sandstone. At the extremity of the Frith, however, its progress is stopped, by the approach of the granite and gneiss mountains of Ross-shire; and, in the Aird, the district lying along the south side of this sea, its uniformity is interrupted by the appearance of granite-hills at a place called Phopachy. These we shall afterwards shew to be the termination of the Second Range, namely, that running from Dochfour to Fort Augustus. This last range conse-

* The vitrified surface does not exceed six or eight inches in diameter.

quently cuts across the line of the sandstone chain, and falls into the sea two miles behind Craig Phadric.

It is in a quarry in this direction, opened, near the village of Clachnaharry, for the use of the Caledonian Canal, that the rare and beautiful mineral foliated celestine occurs. It is found in the sandstone, in minute detached crystals, and in veins, and sometimes associated with calcareous spar.

Having thus noticed the general extent of country occupied by the red sandstone, it is now necessary to enter a little more particularly into its composition.

This red sandstone consists of minute particles of quartz, and a few scales of mica, either simply attached to each other, or connected by a basis of red, seemingly decomposed, felspar. Its coarser varieties form a conglomerate, which consists of pieces, both round and angular, of granite, gneiss, mica-slate, felspar, and common quartz, the whole being cemented by a hard basis of quartz. In many places the rocks are so exposed, that the transition from the coarse conglomerate into the fine sandstone can be easily traced; and when this is the case, the transition either takes place by a gradual diminution of the particles of the conglomerate, thereby passing into the sandstone, or by an alternation of successive layers of coarse and fine stone. Even sections of the same stratum or layer will develope these transitions. Sometimes one part of the mass will be of fine sandstone, and the rest of conglomerate, or unconnected portions of the conglomerate will be found completely inclosed in the sandstone. Frequently an immediate passage can be discerned from the coarsest conglomerate to the finest sandstone, and then the larger fragments appear sticking in the sandstone, as if they had been wedged into it. In regard to the position of these two substances, I have observed, that, although the sandstone and conglomerate frequently alternate with each other, the

higher strata, or the tops of the hills, are almost universally formed of the conglomerate. This may, however, be owing to some external forces, which have swept away the softer and finer strata of the sandstone.

The strata of red sandstone are generally horizontal, but they are also very often highly inclined, and even perfectly vertical. They seldom continue for any great distance straight, but are often waved, the seams between the strata being incrusted with scales of mica. They differ widely in their hardness, thickness, and tendency to decompose.

Such are the results of my examination of this formation. Its junction with the other strata has hitherto eluded my research.

We shall now pass to the consideration of the Second Range, viz. that lying between Dochfour and Fort Augustus.

Second Range.

This chain, from its commencing at Phopachy, is not exactly conformable with the direction of the one just described. It crosses the red sandstone at a small angle, and, if its bearing were produced from Phopachy through Dochfour, it would terminate nearly at Dores, on the opposite side of Loch Ness. The mountains, accordingly, are not parallel with the margin of the lake, and appear rather to be joined together by their lateral planes than by their extremities. The mountains which compose this chain are distinguished from those of the red sandstone already noticed, by their greater elevation, some of their summits being 3000 feet high, by a bolder and more rugged outline, by steeper acclivities, and by a more uniform vertical position of the strata. The general form of the outline is

waving, inclining to conical; but the undulations are shorter, and more numerous, than those of the sandstone.

The most conspicuous mountain in this chain, which is upwards of 20 miles in length, is Meaulfourvoney, distinguished by a single round, huge cap of granite; and the lateral valleys it contains are only two in number, namely, Urquhart and Invermorrison.

In tracing the strata of this range, from the shores of the Beauly Frith, we first met with several low hills, intersected by deep gullies, rising from the sea at Phopachy, nearly four miles to the west of Inverness, and trending in a transverse direction across the country towards the higher and more central mountains, along Loch Ness. These hills, which gradually increase in height as they retire from the sea, are all formed of a beautiful red variety of granite, in which the felspar and quartz greatly predominate over the mica, or of what Professor Jameson denominates *granitic gneiss*. The structure is large, granular, inclining to slaty, and the strata are vertical.

As far as I observed, this granite contained no interposing veins, nor did it seem to possess any additional simple minerals besides those that enter into its own composition. Interposed between these granite hills and the sandstone strata formerly described, is a small tract of grey gneiss. Its existence can be but seldom traced on the side next Phopachy, owing to the quantity of peat and gravel formerly alluded to; but as we advance into the interior, it is more and more exposed; and, on arriving at the acclivity towards Loch Ness, its strata are completely developed in the course of Dochfour, or rather Dochgarroch Burn.

The water of this burn has cut through the rock, in some places to the depth of 100 feet, thereby forming a wild and narrow gully, in which the nature of the strata can be easily and perfectly determined. They seem entire-

ly to consist of one substance, namely, grey gneiss. This rock is of a very soft nature, and hence is easily penetrated by frost and running water. It is disposed into thin strata, which do not rise much above the horizontal position, and are inclined, in this place, towards the south or south-east.

It would be useless to record any of the varieties of this gneiss, as they are but few in number, and depend only on the proportions and colour of the different ingredients. The most interesting circumstance attending these strata is the occurrence of granite veins. These are extremely numerous, and their courses are completely displayed on the sides of the gully. They seldom coincide with the strata of gneiss, but generally cut across their direction, at an angle variously inclined, rarely perpendicular. The granite veins vary in thickness from half an inch to two feet. These veins consist of a red or white, large, granular granite, similar in general to the granite just described, as occurring in the mass of Phopachy hills, but differing as to the intensity of the colour and lustre, as well as in hardness. This latter property is often so great, that I have observed the granite veins hanging over a precipice, after the softer gneiss has been swept away. Their colour also points out their direction among the grey strata of gneiss.

These veins afford a fine study to the geologist, exhibiting great variety of intersection, shifting, and branching; and although the gneiss near to them is sometimes contorted, it also exhibits the same structure where no veins are visible.

To these observations I have only to add, that the gneiss does not extend along the margin of Loch Ness above two miles. It then gives place to a small-grained granite, or granitic gneiss, which forms nearly the whole of the remainder of this chain up to Fort Augustus, and, consequently, the last substance we have to describe in this part of our circuit.

The grains of this granite, which are red, depending on the felspar, vary in size from small to very fine, even to microscopic; and when the rock occurs in this latter state, it might easily be confounded with sandstone. One hill, in fact, not far from Dochfour, which presents a red, crumbling declivity, might apparently be described as composed of red sandstone. An examination, however, of the rock in its original position would soon disprove this fallacy. After passing Maulfourvoney, this granite, which occupies the whole of this chain, at least on the side next Loch Ness, gives place to gneiss, which continues as the prevailing rock to Fort Augustus, and from thence all the way to the opposite shore of Lochaber.

The strata of the granite seem not to be very regular as to inclination and bearing, but their alternations with gneiss are frequent and distinct. Whether this rock is itself to be considered as a mere variety of gneiss, I have not yet sufficiently determined. As far, however, as my partial observation has gone, I have observed little of the slaty structure characteristic of gneiss; but, on the contrary, have almost always found the masses of these strata to be quite compact, and destitute of every appearance of regularity or alternation of the ingredients*.

Their hardness and compactness, in fact, seem to make them well adapted for building; and they have, I believe, been accordingly used in the construction of the locks of the Canal at Fort Augustus.

This mountain range, which may be considered as composed of granite and gneiss, also contains beds of granular foliated limestone, which are situated in the gneiss. The best known beds are those in Glen Urquhart. These beds

* Professor JAMESON, I believe, considers the rock of this district as gneiss.

contain foliated and radiated actynolite, fibrous tremolite, and disseminated iron-pyrites. The tremolite and actynolite occur also associated with a beautiful white variety of felspar, in the neighbouring strata of granite. None of the gems, except rock-crystal and garnet, have been as yet discovered in these mountains: but it is probable that zircon, and perhaps tinstone, might be found, by a careful and minute examination.

Having thus noticed the general characters of the range lying between Dochfour and Fort Augustus, we shall not trace the strata farther towards the west; but, in pursuance of the plan laid down at the commencement of this sketch, continue our description, by giving an account of the chain running along the south side of Loch Ness. This chain commences at Fort Augustus, and terminates near the village of Dores; it forms therefore the third chain we proposed to describe.

Third Range.

For the first eight miles, after leaving Fort Augustus, the mountains in this direction are principally composed of granite and syenite.

These rocks possess no great peculiarities of structure or position. They are not independent formations, but seem rather to be connected with the great ranges of primitive mountains that stretch across the island in a north-easterly direction from Lochaber and the borders of Argyleshire. I need not therefore notice them any farther, as any observations of mine (and they are as yet but few and imperfect) could only corroborate more accurate and better known descriptions. These mountains of granite and syenite are succeeded, near the celebrated Fall of Foyers, by a chain composed of quartz-rock. This beautiful rock has always

been observed by the visitors of this romantic district, but its relations to the neighbouring strata (owing to the natural difficulty and extent of time requisite for the investigation of the subject) have not yet been properly ascertained. It would, in fact, require a person resident in the country, and well acquainted with its geography, to undertake such a labour with any hopes of success.

The outline of this chain is of a smooth conoidal shape, with regular and nearly equally undulating hills, which rise to a great height, and are extremely bare, from the thinness of the soil, and the hardness of the strata.

The quartz-rock possesses in general a brecciated or conglomerated character, and consists of portions of granite, gneiss, mica-slate, quartz, and felspar, united either by a white or a brownish basis of hard quartz; they also simply adhere or penetrate each other. In some instances, chlorite occurs instead of mica-slate; and it is not at all improbable that a minute examination would detect large beds of that substance.

Small specimens are seldom found to illustrate the distinguishing characters of this quartz-rock; but in large masses, the imbedded portions, both round and angular, are easily observed, and are seen to vary from the size of a pea to several feet in circumference. This conglomerated rock differs from the corresponding member of the red sandstone formation, by a fresher and more crystalline appearance, by a want of the general dark-red colour, by forming mountains of a higher and more broken outline, and by not containing any portions of true sandstone. I have only farther to remark, that this chain is also connected with the central ridges tending towards Badenoch; but that, in the direction of Loch Ness, it stops near the above mentioned village of Dores, which lies at the southern extremity of the lake.

Fourth Range.

Resting upon, and immediately succeeding the mountains of quartz-rock I have just been noticing, there occurs a ridge of a lower and smoother outline, which commences above Dores, and, after passing, in a continued line, by the Muir of Culloden, gradually falls into the low lands situate between Fort George and Nairn. The bearing of this ridge tends more to the east than that of the chain immediately preceding it, and hence it does not lie in the prolonged line of the edge of the Loch. Consequently, between this ridge and the centre of the valley, which we may consider as the river Ness, there intervenes a space of from one to two miles. This space is covered by a series of alluvial matters, which, together with a similar deposit fronting the sea between Fort George and Inverness, shall be afterwards particularly noticed. At Dores, one or two hills occur, formed of red sandstone, and described several years ago: they are quite partial, and are to be considered as parts of the sandstone formation formerly described, as extending to the neighbourhood of Dochfour, on the opposite side of the valley.

This ridge, which forms the fourth and last chain in the circular view from Inverness, is known under the name of the Leys, and may be distinctly seen in its whole length from the rising ground immediately above Inverness. As seen from this position, the Leys seem to proceed from the borders of Loch Ness, or Strath Errick, and run in an uniform direction all the way to Nairn, where they are lost among the alluvial and sandstone formations of that county. The most singular character of this ridge, and the one which distinguishes it from every other chain in the country, is its

unbroken outline throughout its whole extent, of about twenty miles.

The height of this ridge is from 300 to 500 feet, and the acclivities on both sides are gentle, and covered with a deep bed of alluvium. The cover of alluvial matter is so considerable, as in general to conceal the strata, thus leaving us as the only means of becoming acquainted with them, the inspection of quarries. Judging from these quarries, the whole range appears to be distinctly disposed in strata, generally slightly inclined to the horizon, and composed of slate-clay inclining to clay-slate, red sandstone, and occasionally conglomerate, sometimes bearing a considerable resemblance to greywacke; and, like some of the varieties of sandstone, bearing marks of being in part the results of a process of crystallisation.

In these strata, a few simple minerals are met with, such as arragonite, heavy spar, calcareous spar, and iron-pyrites.

Alluvia.

The mountainous ranges encircling Inverness, I have shewn to consist of gneiss, granite, syenite, quartz-rock, slate-clay, red sandstone, and conglomerate; and it now seems necessary, for their final elucidation, to describe the characters of the alluvial matters in the Great Valley surrounded by these mountains.

The principal part of this space is covered by the waters of the Moray Frith and Loch Ness, and the remainder forms the bed of the Caledonian Canal.

At Fort Augustus, the highest point of this extensive Valley, an alluvial collection, composed of the debris of the neighbouring mountains, spreads itself between the Lakes

Ness and Oich; and a similar bed of gravel, except where interrupted by Loch Lochy, can be traced to the opposite shore at Corpach, near Fort William. These alluvial deposits have always supplied abundance of materials, and a compact bed for the line of the Canal, while the absence of large masses of fixed rock contributed to render the work more expeditious. Another alluvial flat, free from large rocks, though otherwise rather loose in texture, occurs at the lower extremity of Loch Ness, between it and the sea, thus completing the track of this great Canal. All these alluvial beds are similarly constituted; and hence, by describing those in the immediate vicinity of Loch Ness, we may form a very good idea of the whole.

Between the Murray Frith and Loch Ness, these deposits arrange themselves into three flats or banks. The first and lowest, is the one through which the river Ness and the Canal run, and on which the greater part of the town of Inverness is built. Removed a little way back, but rising above this to the height of 50 or 60 feet, and occupying the space between the south bank of the river and the ridge of the Leys formerly described, appears the second flat, or table-ground. And, lastly, on the opposite side of the Ness, proceed, from the confines of Dochfour, a series of low, waving, and steep hillocks (not surpassing 200 feet in height), which terminate, after a run of six miles, with the celebrated Phorvaine, and Pomnahurich, or the Fairies' Hill. This last set of hills are inclined to the sandstone range bounding this northern side of the Valley, at an angle of from 30° to 40°.

Agreeable to this account, a person proceeding from the river towards the south, would first pass over the lower flat, which appears in the form of a beautiful strath, of from one to two miles in breadth; and then, after ascending a steep bank (of 40 or 60 feet in height), he would come

upon a fine smooth plain, bounded on the south by the Leys, and containing on its surface many of the richest and most beautiful farms in the country. This second flat, which is the most interesting of the three, commences near Loch Ness, and runs all the way to Fort George, a distance of from 14 to 18 miles. It comes close in on the back of Inverness, forming the Castle-hill and the site of the ancient castle of MACBETH; and then turning to the east, it proceeds along the coast, towering above the sea, or retiring into sweeping and verdant banks. Its breadth between the Leys and the sea varies from one to four miles; but the most interesting circumstance attending it is, that a similar gravel bank, of the very same height and character, can be traced, with very few interruptions, along the whole of the Beauly Frith, and on the opposite shores of Ross-shire.

I shall now mention the substances of which these alluvial beds are formed. These consist of fragments of rocks belonging to the primitive and secondary classes, and they exhibit not only all the varieties found in the mountains of the neighbourhood, but also many that appear to have come from very distant parts of the country. Such are the white stone of Ben Nevis and Strath Conon in Ross-shire, and the quartz-rock of Foyers. The substances of this gravel occur in nearly horizontal beds, which vary in fineness from the smallest sand to round boulders of several feet in circumference. The most general size, however, of these fragments, is that of a man's head, or of a large cannon-ball. The rocks of which these are composed, are principally the following, viz. granite, syenite, gneiss, mica-slate, seldom or never clay-slate, varieties of primitive trap, green-stone, and felspar-porphyry; quartz-rock, chlorite-slate, white-stone, fresh common felspar, common quartz, and precious serpentine. Of the secondary rocks, I only

observed red sandstone and its conglomerate, occasional pieces of white sandstone, but never any of the secondary porphyries or trap-rocks. Clay occurs but seldom, and hence the sandy nature of the soil in this district, and consequent badness of the crops in dry seasons. Marl has been discovered in one or two places, which were formerly the bottoms of fresh-water lakes, but which are now deeply incrusted with a layer of peat.

XVII.—*Observations on the Immer Goose of Zetland.*

By LAURENCE EDMONDSTON, Esq.

(*Read 6th April* 1822.)

THERE are few birds to which anomalous and perverted instincts have been more ascribed than to the Colymbus Immer. It has been represented as incapable of flying,—as crossing boisterous oceans merely by swimming,—as hatching its egg under its wing, or forming its nest on the surface of the water. And nothing more clearly demonstrates the necessity of investigating patiently the habits of birds in their native retreats, than the fact of the singular improbabilities that have so long been mingled with our information of a species which, from its number and general diffusion, ought long since to have been correctly known.

The erroneous and fanciful opinions which relate to this species, seem to have been delivered either on obscure or credulous authority, or as loose assertions unsupported by

actual observation, intended to account for what seemed to be difficult. And it does appear surprising, that the only supposition which obviously resolves or precludes these obscurities, should not have at once presented itself to minds in the least degree habituated, not indeed to closet, but practical ornithology.

In prosecuting this interesting branch of natural history, I was soon struck with the unsatisfactory and obscure opinions generally entertained regarding many species of the Colymbus genus, and more especially the Immer; and I early embraced the opinion, that this bird was merely the young of the Great Northern Diver: but I determined to confirm this by patient observation, and particularly by contrasting the two birds together, and it was not long before this opportunity was afforded me; it has since been frequently repeated, and has left no doubt on my mind of the accuracy of the opinion I had first formed.

The Immer is found during the whole year in Zetland, though in summer it is rather less numerous, and at this season it is most frequently met with in *single* individuals. Its nest has never been discovered, nor has its young been observed accompanying it. Its size and plumage in different individuals are various; its organs of generation indistinct.

These facts, taken in connection, prove, I think, this bird to be not yet arrived at an adult state; and they agree perfectly with its general description by naturalists.

That it is the young of the Northern Diver, is, I conceive, equally established in every respect.

I have examined specimens in all the different gradations of plumage, from the more imperfect appearance of the Immer till it had almost attained the beautiful and well-marked plumage of the *C. glacialis.* These specimens, apparently just passing into the adult state, were mostly observed during summer, and too early in the season to sup-

pose them to have been the brood of that year. Those, on the other hand, which I have met with in autumn, were chiefly in that plumage most distant from the appearance of the Northern Diver. The size, general aspect, and voice of these two birds—their modes of swimming, diving, and flying, are precisely the same. They frequent the same situations, and live on the same food.

I have seen repeatedly, in Zetland, in autumn, and at that period when the young of the *Glacialis* might be expected to be full grown, and to arrive in that country (or, if hatched there, to appear in the bays), families, consisting of two northern divers and two immers, apparently inseparable, and the actions of each toward the other quite characteristic of the reciprocal relations of parent and young bird.

The immers, in this contrasted situation, seemed as large as the others, but did not swim so erect, or look so lively and active, and were chiefly distinguished by the absence of the white bars across the neck; they were also less easily alarmed. When fired at, the northern divers took wing with facility: the immers also, but apparently more reluctantly; and after flying for a short distance, soon alighted, when the others, as if unwilling to relinquish the care and protection of their offspring, dropped again beside them.

That the immer should use its wings less than the adult bird, is only what might be anticipated from the analogy of the habits of many of the species of this family, the young of which go to sea almost immediately after bursting the shell; and hence, being so early habituated to diving, as a resource of food and safety, seldom use their wings, but when driven to extremity, or to effect distant and dangerous migration. It is accordingly in autumn, immediately after their arrival in Zetland, that the immers are most frequently observed

to fly. They are more numerous also at this season, when they are seen in companies of three or four individuals, and are usually more accessible than at other periods of the year. They then appear fatigued and emaciated, evidently from the effects of a long voyage; and are more intent in searching for food than providing for their safety.

It flies with rapidity and ease, though it generally prefers diving, to elude its pursuers. Its wings are very muscular, but it does not employ them to assist its motion under water, as some other birds allied to it uniformly practise*.

In Zetland, no distinction seems to be known between the Immer and the Glacialis, and, when the latter occurs, it is termed Immer.

The Colymbus Immer, therefore, is merely the young of the Great Northern Diver; and what here remains to be stated, applies equally to both birds.

I have little doubt that a few pairs of the *Colymbus glacialis* breed in the more secluded morasses or islets of Zetland; but these could not by any means supply the number which are met with at all seasons among these islands, where, indeed, it is rather a numerous species.

It is one of the most expert divers; and its movements in its native element are highly graceful. No bird with which I am acquainted can remain so long under water at one time. It is partial to sheltered and retired bays, though it is very often found in the more exposed situations, and is well calculated to brave the utmost fury of the storm.

It is never seen on land, even for repose, but only when wounded, or diseased. Its sleep is taken on the water, and

* The fact of this bird being able to fly, was, I believe, first stated by Dr Edmondston, in the first volume of the Transactions of the Wernerian Society.

seems often to be continued for some hours together: with its head under its wing, it may be frequently observed passively floating in the direction of the wind or tide, but always sufficiently on its guard against surprise. It is peculiarly fond of sand-eels (*Ammodytes tobianus*), and may commonly be expected to be met with where these abound.

The plumage on the body is so full, and the skin so thick, that small shot makes little impression when the back of the bird is not turned to the sportsman; and it is therefore the practice of the experienced to wait for this favourable situation, or to take aim chiefly at the head or neck. It dives with great celerity on the flash of the pan; and hence another precaution for securing its capture, that of waiting for the momentary dipping of the bill in the water,—a habit which most of the divers practise from time to time as they swim along the surface.

It is exceedingly tenacious of life. I have seen it even when mortally wounded, with its head literally shattered, and the brain perforated in various directions, still struggle to escape, with almost undiminished vigour and sagacity; and as it seemed impossible to kill it speedily, without unfitting it for being a specimen, the sportsman, relenting at its torments, has been compelled to put an end to them, by beheading it.

From its marked tenaciousness of life, and comparatively superior power of suspending respiration for a considerable time, I am disposed to expect some peculiarity of structure in its vital organs, and, with this view, shall avail myself of the first opportunity that occurs for its accurate dissection.

I am at present engaged in endeavouring to determine the validity of the claims of other birds of this genus to be

considered as distinct species. So far as I have gone, I am disposed to consider the *Black-throated* and the *Red-throated Divers* as the same species; and I have no hesitation in asserting my belief of the *Speckled* Diver being the young of the latter. I once shot a bird quite corresponding with the description of the *Colymbus stellatus;* and on examining carefully the under part of its neck, I found several ferruginous feathers just shooting forth, and the bird, in other respects, beginning to assume the plumage of the Red-throated Diver. Another Speckled Diver has indeed been described, but I do not perceive that it differs in any essential respect from the *C. stellatus.*

If these views, then, be correct, we shall find only two distinct species, the *Colymbus glacialis* and the *C. septentrionalis,* where six separate species have been usually described.

Edinburgh,
1*st March* 1822.

XVIII.—*A Description of two New Plants of the Order* Algæ, *found in Scotland.*

By R. K. Greville, Esq. F.R.S.E. M.W.S. &c.

(Read 26th January 1822.)

Echinella, *Lyngbye.*

Gen. Char. Massa sub-gelatinosa, granulis solitariis, cuneatis, elongatisve, farcta. Lyngb.

Echinella circularis, *mihi.*

Echinella, filis simplicibus, strictis, longitudinaliter æqualibus, compactis, cuneatis, in circulo plano dispositis. Tab. viii. fig. 2.

Hab. In paludibus et rivulis lentè fluentibus, sæpe ad folia mortua, &c.

Individual plants very minute, but, from generally growing in considerable quantities together, the species is sufficiently conspicuous. It exists, either in dense masses, of a dull-green colour, with a slight submetallic lustre, or occasionally dispersed and attached to the stems of rushes and

grasses, dead leaves, or any substance immersed in the water. The form is perfectly circular and plane; the filaments or bodies of which it is composed, numerous, wedge-shaped, and more or less translucent; towards the base generally, but sometimes in the middle, of each wedge-shaped filament, is a transverse line; but I have not been able to ascertain whether any separation takes place at that part. From its fragile nature it rarely happens that a complete circle is seen, but I have oftener than once obtained more than three-fourths of one. The circles are of different sizes, and the filiform bodies composing them of different diameters, and consequently some are more wedge-shaped than others; those of the same circle are, however, generally uniform. The colour is a greenish-yellow (as far as the coloured portion extends), but there is always a considerable part of each cuneiform body crystalline or transparent, which may arise from a collapse of the contents. In the centre of each circle or congeries of plants, is a circular unoccupied space of small diameter, which being invariably present, may perhaps be its place of attachment to the substances on which it grows.

Of this most singular genus, LYNGBYE, in his excellent *Tentamen Hydrophytologiæ Danicæ*, has described nine species. Mr ARNOTT and myself have ascertained three of these to be natives of Scotland, viz. *E. fasciculata*, *E. geminata*, and *E. paradoxa*; besides another, that may probably prove a new species.

Early in 1820, I found this plant in a rivulet near Dumbryden Quarries. Soon after, Mr ARNOTT met with it, and determined it to be new. I again procured it in March 1821, from watery places in the King's Park, Edinburgh.

GLOIONEMA, *Agardh.*

GEN. CHAR. Fila gelatinosa, tenacia, continua, intus longitudinaliter farcta sporangiis ellipticis.

Gloionema apiculatum, *mihi.*

Gloionema; fronde continua, filiforme, ramosa aliquando fasciculata; granulis cylindraceo-oblongis; apicibus ramulorum incrassatis, apiculatis. Tab. viii. fig. I.

HAB. Ad saxa marina, ubi ab undis marinis fere semper inundatur.

This plant, which appears to have hitherto escaped the observation of botanists, grows in the form of small lax tufts, from half an inch to near one inch in height. The individuals which compose them are filiform, about as thick as a hog's bristle, of a yellowish or olive-green colour, extremely flexible, and yielding to the slightest motion of the water; and although very tender to appearance, they possess considerable tenacity. Each thread or stem is at first simple, and subattenuated at its base. It soon throws out a few branches (sometimes in a fasciculated manner), which are continued simple to the summit, where they are not unfrequently shortly forked. The apices of the branches are incrassated, of a darker colour, and terminate in a remarkable semi-transparent apiculus, which of itself is sufficient to determine the plant. The whole frond is filled with a gelatinous transparent mass, containing throughout its whole substance oblong and cylindrical granules, which escape by incision and slight pressure.

It adheres closely to paper and mica, and, if preserved on the latter, recovers its form on being moistened with water.

This plant does not appear to be unfrequent in the Frith of Forth. Early in March 1821, I found it, in company with Mr Arnott, on the Black Rocks at Leith; it grew there at the bottom of small pools left by the tide at almost low water-mark. I have since found it more sparingly between Newhaven and Caroline Park, midway between high and low water-mark, on rocks, and intermixed with young plants of *Ectocarpus littoralis*.

Gloionema contains a small number of very extraordinary plants, which have puzzled every naturalist who has touched upon them. Of the two latest writers, Agardh and Lyngbye, the former has been most successful in establishing a good generic character: his own observation it may be worth while to transcribe.—"Species vere singulares et loco dubias continet hoc genus; neque satis scio, an revera tres illæ, quas huc congessi, unius ejusdemque generis sint, cum non nisi unicam vivam vidi, reliquas duas tantum siccatas. Multa tamen communia habent, sed adhuc dubium comprimere nequeo, an Gl. paradoxum sit vegetabile, nec ne."—*Aq. Syn. Alg. Scand.* p. xxxv.

Agardh has only described three species, *Gl. paradoxum*, *Gl. chthonoplastes*, and *Gl. fœtidum* (*Conferva fœtida* of Dillwyn). Of these, the first and the last I suspect can only be retained; the other (*Conferva* of the *Flora Danica* and Dillwyn, and *Oscillatoria* of Vaucher and Lyngbye), whatever genus it be referred to, must be excluded from *Gloionema*. Mr Gray, who, from the prodigious number of new genera he has himself, or in conjunction with others, manufactured in his late work, stands some chance of having a few of them adopted, has, from this singular plant, constituted a new genus, under the name of *Vaginaria*, a distinction which it seems really to deserve.

Lyngbye, in addition to the above Agardhian species, has described, under his genus *Bangia*, one decided *Gloionema*, viz. *B. rutilans* (*Conferva rutilans* of Roth. *Cat. Bot.* iii. p. 179.) His *B. quadripunctata*, if not truly *Gloionema fœtidum*, of which he is himself doubtful, also belongs to Agardh's genus, and perhaps also his *B. micans*, but of this I cannot speak with equal certainty.

The genus *Bangia*, if made to include those plants only which have the internal granules disposed in the form of transverse striæ, would be a very excellent one, and would comprehend all the species it has at present, excepting those I have named as belonging properly to *Gloionema*; it would be composed of *B. crispa, laminaria, fusco-purpurea, atrovirens*, and *mamillosa*, all of which have a distinct and common character.

B. laminaria has been detected in Scotland by Mr Arnott.

Explanation of Plate VIII.

Fig. I. *Gloionema apiculatum*.
1. Tuft of plants natural size.
2. Plants magnified.
3. Summit of a branch of do.
4. Granules.

Fig. II. *Echinella circularis*.
1. Plants magnified.
2. Do. very highly magnified.

Edinburgh,
20th January 1822.

XIX.—*Some Observations on the Natural History and Habits of the Mole.*

By the Rev. James Grierson, M. D. M. W. S.
Minister of Cockpen.

(*Read 9th March 1822.*)

The adaptation of the objects of Nature to one another, and to the state in which they are found to exist, must, to every intelligent observer, appear beautiful and striking. This is perhaps nowhere more conspicuous than in the structure and instincts of animals. Like all other things, however, it affects us the less forcibly in proportion as it is familiar and ordinary. There are many animal instincts and dispositions that would appear exceedingly curious, and in the highest degree interesting, were it not for their familiarity. Not to speak of the bee, the ant, the swallow, and many others well known, there is, I think, something exceedingly interesting in the structure and habits of the Common Mole (*Talpa Europæa* of Linnæus).

Had we never seen or heard of such an animal and its operations, and were we to be told by a traveller, that there

existed in some distant country a little quadruped, covered with a very thick and soft down, which lived constantly under ground, forming to itself roadways below the surface, and travelling in them to the distance of 40, 50, 100, or even 200 yards, making these subterranean roads of just such a height and breadth as to be convenient for itself, and casting up in heaps the superfluous materials in its way, and forming to itself convenient and comfortable lodgings in the bowels of the earth, we should certainly think it a very curious, or perhaps an improbable narration. But this is nothing more than a description of the Common Mole, that little active animal which we all so well know.

As I have never actually witnessed many of the facts I am going to detail concerning the operations and habits of the Mole, I must state to the Society, that I take my information with regard to them from a most experienced and scientific mole-catcher, Mr Robert Fletcher, gardener in Bonnyrigg, near Dalkeith. Mr Fletcher is a man of great ingenuity and accuracy of observation, and every dependence is to be put on his statements. He is the inventor, too, I would beg leave to observe, of a most important improvement in the construction of vineries, of which he has now had the experience for many years, and finds to answer perfectly. The improvement is the making of the vinery of a circular form, so as to enable the plants in it to enjoy the benefit of the sun's direct rays as long as that luminary is above the horizon. He finds this so advantageous to the fruit, that he never misses an abundant crop of grapes, and those of a quality superior to what are usually produced in houses of the old construction. General Durham of Largo, and Mr Millar of Arnock, have both had grape-houses constructed on Mr Fletcher's plan, and find them perfectly to answer. I have also seen other inventions by him of

great ingenuity and utility,—particularly a sort of rake, connected with a roller, for the purpose of breaking down, pulverising and cleaning rough ground, which I would term a Regulated Harrow; and a conical windlass, which works by a rope thrown two or more times round it, joined again at the two ends, and running in a moveable block suspended below the roller, and to which block the weight to be raised is attached. This invention is extremely simple, and deserves to be universally known. It is perhaps the most powerful mechanical contrivance that has ever been thought of, and is found to answer extremely well for rooting out trees. I think it should be named *Fletcher's Conical Windlass*.

But to return.—The size and exterior appearance of the Common Mole is so well known, as scarcely to require description. We all know it to be a little quadruped, of five or six inches in length, covered with a soft fur-like down, and of an iron-black colour (white individuals sometimes occur), the feet being exceedingly short in proportion to its body; the fore ones much larger, stronger, and more muscular, than the hind ones. Indeed, the mole can scarcely be said to have any fore legs. The feet seem to be fixed to the sides of the animal, without the intervention of legs. Each foot is armed with five claws or fingers, fortified with long horny points, the middle claw being a little longer than the rest, somewhat analogous to the human fingers. The fore-feet are almost twice the breadth of the hind ones, exceedingly strong, and well calculated for digging in the ground. The snout is long, and very much in the shape of that of a hog; the under jaw being extremely short in proportion to the upper one; or, I should rather say, that a flexible snout or proboscis projects about half an inch beyond the under jaw. The head seems fixed to the body, without the intervention

of any neck. The tail is about an inch long, and covered also with down. It is observed, of almost all animals, that the colours of the belly, or that side of the animal which is usually towards the ground, or shaded most from the light, are of the faintest hue. In the mole, this distinction is, I think, less observable than I have noticed it to be in any other. Its belly is very little, if at all, lighter than its back. This may be owing to its being almost all equally exposed to the light, or rather all equally excluded from it. The male is considerably larger than the female. They couple in the month of March, and the female brings forth in May. She produces usually six or seven at a litter. On some occasions they seem to breed twice in the year. Mr Fletcher has seen young moles in September, but this, he says, is rare. The new-born moles are quite naked and red.

The males often engage in fierce combat with one another, particularly in the spring season. Mr Fletcher has witnessed this, and seen them seize one another with their teeth, and push and scratch violently with their claws, till both were much torn. He observed another curious fact lately, in the Duke of Buccleuch's Park, at Dalkeith. He found a male mole caught in one of his traps, and the entrails of it torn out, apparently by another mole. A few minutes after, he observed a mole moving along the track, or run towards the trap, and killed it with his foot. On taking it up, he found it to be a female. The same day, and near the same place, he found another male caught, and in the same state as before described; and he killed another female in the same way coming towards it. Had these affectionate and disconsolate wives thus torn their husbands in endeavouring to extricate them from their disastrous situation? Or are we to suppose them actuated by a different sentiment,—full of anger at their silly mates for being so stupid as thus to fall into the snare?

Each of the males, when taken up in that torn state, were still warm.

The mole constructs a snug, comfortable nest, in which to deposit her kittens. It is commonly found in a grass or corn field, about even with, or at no great distance below, the surface of the ground, and formed of grass, moss, stubble, or whatever else the field produces. It is always, of course, covered above; and, to prevent the rain from penetrating through the roof, there are placed on the top of this two drains or gutters, at right angles to one another, formed of consolidated earth, and having a gentle slope, in all the four directions, away from the nest. A jakes, or place for retiring to when about to evacuate the fæces, is always found at a little distance from the nest, say nine or ten inches distant.

The food of this animal seems to consist mostly of the common earth-worm, and it is in pursuit of these that it makes such mighty efforts in the formation of its subterraneous roads, and thereby often annoys so greatly the gardener and the farmer. The worms themselves often perceive the approach of their enemy, and struggle to escape from him. Mr Fletcher has seen them flee from the mole, and the latter come out of the ground after them, and catch them. But moles seem to prey upon other animals besides the worm, for this same observer once saw a mole that had seized a frog, and was killing it.—It is commonly thought that the mole goes every day to the water to drink. Mr Fletcher, however, doubts the truth of this very much. After many years observation, with the best opportunities, he has never once seen them drink. He is likewise disposed to believe, that they do not void urine separately from the fæces; but as dissection shews that this quadruped, like every other we are acquainted with, has a urinary bladder, the above opinion is rendered

less probable. At all events, as a proof that the moles do not go every day to the water, Mr Fletcher tells me, that his father (who followed the same profession with himself) and he found them on the top of Arthur's Seat, at a great distance from the nearest springs, or any water. Probably the reason why the moles have been thought to go every day to the water, is, that their workings are often found near the sides of rivers or rivulets, or in the moist parts of fields, particularly in dry weather. But this arises from their finding most worms in those situations.—It is observable, that the moles make always greatest havoc in the way of throwing up hillocks or heaps in the winter season, or in the coldest weather. This arises from the necessity under which they find themselves in such a case to construct their runs, bores, or roadways, at a greater depth; for the worms in the winter season, or in cold weather, keep far below the surface, so that the moles, in following them, must go farther down, and of course have more occasion to throw up earth. In summer, when the weather is warm, and when there is enough of moisture on the surface of the ground, the worms are on, or near it; and then the moles, in hunting them, run among the roots of the grass, and have no occasion to throw up hillocks. For the reason why they ever do so, is this. They do not engage in the work as a matter of choice, or of amusement, or of wanton mischievousness; but of necessity, in the way of procuring their daily food. When they are a considerable way down, say three or four inches, for they seldom go deeper than about twice that distance from the surface, they are then unable to move all the earth immediately above them, and must, in order to get forward in their work, contrive some plan of clearing away the materials they detach. The plan they adopt is the following. The mole forms an upright, or rather a sloping shaft, and, as

he detaches the earth with his strong fore-claws and snout from the front of the run or drift that he is making, he pushes it backwards, in successive quantities or loads, as we may call them, to the sloping hole or shaft which he had opened, and by main force, and successive efforts, heaves it up till it forms a hillock,—imitating, in this way, pretty exactly the operations of colliers and other miners; except that these employ machinery to bring their materials up the shaft, whereas the poor mole has to push all up by mere muscular exertion. A mole makes his bore very little wider than himself, and, in working, he seems to drag his materials backwards toward the shaft, and then push them up. He can, however, at certain places, readily turn himself in his road; and he can run along it with his back downwards, very nearly at the same rate as when he has it up. Mr Fletcher has often taken moles in his traps in this inverted position. It may be thought surprising how much work one of them will do in a short time. He will throw up six or seven heaps or hillocks in a single night, each of them not weighing less, by estimation, than six or seven pounds, so that he may be said to remove forty or fifty pounds of earth in a night. And it is observable, that, however hard the ground may be in which he is digging, the claws are always as sharp as needles.

As the heaps thrown up by the moles, and the roads they make among the roots of the plants and the seeds sown, are both great deformities, and injurious to the productions of the garden and the field, it is an object of considerable importance to know the best and surest method of catching or killing these animals. Three different methods have been thought of,—poisoning; watching the mole at work, and coming upon it with the foot or some instrument; and setting a trap for it. The first, I believe, is seldom had recourse to; though I understand it has some-

times been tried, and is said to have succeeded. But as I have had no opportunity of reducing it to the test of experiment, nor of seeing any one who has, I cannot pretend to describe it. I have seen the following recipé for poisoning the mole; but as I have not tried it, nor heard of any one who has used it, I can say nothing of its merits:—"Take a handful of oatmeal, and pour so much water on it (stirring it all the while) as to bring it into the consistence of porridge, or thin brose. With every English pint of this, mix ten grains of corrosive sublimate. Pour a small quantity of this mixture on a piece of board, and lay it close by the mole's hill. Drop on it twenty drops of the oil of rhodium, or of the oil of thyme, which has had a grain or two of musk mingled with it. The poison is to be put down at night, and in dry weather."—It is not likely that this should answer, as the mole is a carnivorous animal; but perhaps it sometimes, like the dog, takes vegetable food.

In the "New Monthly Magazine," for March last, No. 15. (published in London), I observe the following notice concerning moles.—"A gentleman," says the writer, "who was troubled with these animals in his garden, adopted the following method by way of experiment. Having opened one of the runs or trenches, he introduced a small quantity of rosin and sulphur, and, when in a sufficient blaze, covered it over with the mould drawn from the trench. Whether suffocation ensued, or (what is more probable) the fumes were highly offensive to the finer instincts of these animals, the purpose was completely answered; as they never afterwards made their appearance."

A top-dressing of quicklime will sometimes clear a field of moles. Mr Fletcher once saw this effect very strikingly accomplished in a field of Captain Preston's, at Gorton. It was quite over-run with moles; but after the liming, they all disappeared; probably in consequence of

the lime having destroyed the worms on which the moles feed.

The mole may often be killed by watching it at work, or when it is engaged in forcing up the materials it digs out of its run. If you can then suddenly get in below it with a spade or hoe, you may throw it out, and destroy it; or you may come upon it with your foot, and fix it in the ground, till you get it thrown out by some instrument. To accomplish this, you must watch till you see the hillock where a mole has been recently at work begin to heave, and you must ascertain, at the same time, in what direction the mole is going. For example, if she appear to be carrying on her operations, or making her road towards the east, you may be sure she is, when you see the hillock move, pushing her materials towards the west; and, therefore, in order to secure her, you must turn your back to the east, and then tread hard and heavily on the east side of the hillock. You will then most likely fix her. But if you come on her the contrary way, she will turn back in a moment along her roadway, and escape. Some have employed, with good success, to kill moles at work, a board, either of a square or circular form, containing about 100 square inches, fixed on the end of a stick a few feet long, and stuck full of iron-spikes four or five inches in length. This instrument, plunged right upon the heap or hillock when the mole is seen to work, can scarcely fail to destroy her. But in order to catch a mole at work, the greatest softness of approach is required. It is scarcely possible, such is her acuteness of hearing or feeling, to get at her without throwing off your shoes, and walking in your stockings, unless it be near by the side of a road, or other place, where there are constantly noise and shaking of the ground, by means, for example, of horses and carts, or carriages, passing and repassing; and then the mole may be approached when at her work with great freedom. She does not take the alarm.

But the most usually successful method by far, of destroying the mole, is by means of traps, and of these there are various constructions. That used by Mr Fletcher (and he makes these traps himself) is very simple, and so perfect in its kind as scarcely to admit of improvement. The prime cost, too, he tells me, of each of his traps is only threepence. It consists of a piece of wood four inches and five-eighths long, two and a quarter broad, and about a quarter of an inch thick, with a hole a quarter of an inch diameter in the middle of it, and a slit or mortice cut transversely an inch long, and one-eighth wide, within half an inch of each end of it, leaving at each end of this transverse slit or mortice about half an inch; into which space, at each end of the slit, are fixed the extremities of a strong double iron-wire, so as to form a circular arch, or almost a ring of two inches diameter. A plug of wood, an inch and a half long, is made to fit the hole in the middle of the board, and is employed to act as a trigger; for it is put in when the trap is set, only so gently as to be removeable on the slightest touch. Two pieces of good brass-wire, deprived of the temper, and then formed into two rings of three inches diameter, are each fixed to one end of a piece of strong well-made fishing-line, or gardener's line, of eighteen inches long. The line thus armed, is doubled in the middle, and a knot cast on the double line two inches from the rings. These wire-rings, in this way, when laid together, exactly correspond with one another. A small piece of line, about an inch long, is fixed to the other, at the knot. I may mention, that the trigger is also fixed to the board by a piece of line tied round it, to prevent it from being lost. Things being thus prepared, the brass-wire rings attached to the ends of the line, are put each of them through one of the slits in the board, and fitted in betwixt the sides of the double iron-wire rings, so as to correspond with them.

The small piece of twine attached to the knot on the double line is then put through the hole in the middle of the board, and the trigger is put in on the other side of the board, or that in which the double iron-rings are (viz. the under side of it), so as to prevent the bit of twine from being drawn back again. The board or trap thus prepared is now put into the mole's track or run, and fixed down by two pieces of wood eight or nine inches long, sharpened at one end, and having a cleek or hook at the other. Then a piece of a green or fresh stick three feet long, and about half an inch thick, is stuck into the ground by one end, at such a distance, as that, when bent down, the other may be over the middle of the trap. This is the spring. Holly answers very well; but Mr Fletcher finds that a rod of common lilac forms the best spring, this wood preserving its elasticity much longer than any other. The doubling of the line is then put over the end of it, and so the trap is set. As soon as a mole comes along the track, and touches the trigger, the small piece of twine, which by means of it held down the spring, is let loose, and so the spring acting pulls up the brass-wire-rings attached to the ends of the line, and the mole is thus caught by the middle, and killed, being squeezed against the board.

The grand secret of mole-catching, by the trap, is to find out an old run or roadway, for such the animals seem frequently to pass along. Each mole, or couple of moles about the time of breeding, seems or seem to have a particular track or district of road, below ground, which they frequent, and from which, at the most convenient places, they make drifts or runs, in pursuit of worms. An old run is often found along the side of a hedge, or of a walk in a garden, or of a box-edging, or the like. In a field, it is detected not unfrequently between two sets of hillocks. A run may often be discovered by thrusting into the ground any small sharp

instrument, such as a common garden-weedock; and that in which you place your trap, should, if possible, be not more than two or three inches below the surface of the ground. When the run lies deep, it becomes inconvenient for setting the trap. A little experience will soon enable you to discover an old run or track.

It has been questioned by some whether moles have any organs of vision; but that they have, must now be universally admitted. Their eyes are, however, exceedingly small; and it may be thought that, from the usual mode of life pursued by these animals, the sense of sight can be of little use to them: yet there are facts to shew, or, at least, to render it very highly probable, that they see to a considerable distance. I have been favoured with one very remarkable fact of this sort, by the Reverend William Macritchie, minister of the parish of Clunie, in Perthshire, a member of this Society. It would seem to prove, that moles have a much more extensive sphere of vision than might at first be imagined. The account of the fact alluded to, as transmitted to me in a letter by Mr Macritchie, is so full and satisfactory, that I beg leave to copy his *ipsissima verba*. Indeed I should not in any other way do justice to the subject.

"*To* Dr Grierson.

"*Manse of Clunie, 25th March* 1822.

"Dear Sir,

"I have your favour of the 19th current, and, in reply to your queries respecting the Mole mentioned to you by our friend Dr Baird, I beg leave to state the following particulars.

"Though the fact, alluded to by the Principal, did not fall under my own observation (it having happened about two months previous to my coming to reside here), it was

repeatedly confirmed to me by the verbal testimony of three honest men, on whose veracity I had no hesitation in relying. They all three saw the mole, handled it, examined its eyes, &c., but did not observe whether it was a male or a female. Two of the men are since dead; the third is still alive, and has been my next-door neighbour for these thirty-seven years past: and had I had no other authority but his own for the truth of the fact referred to, I should have regarded it as altogether satisfactory. He has been long settled here as gardener and nurseryman to the Earl of Airly,—has himself been the death of many moles in his day, and was himself the death of the very individual mole in question. He has this very day, and not an hour ago, told me, that he recollects the circumstances that attended its death, more perfectly than many thousand things that have happened to him since.

"It was in the year 1785, within a day or two of the summer-solstice, on a calm, mild evening, between nine and ten o'clock, when the surface of the lake was as smooth as a mirror, he, and another of the men above mentioned, had rowed about fifty yards from the island towards the mainland, when they observed the creature steering its course from the mainland towards the island, and approaching to their boat. The gardener took off one of the oars, arrested the poor little voyager on its passage, struck it with the oar, killed it with the stroke, took it up, and handed it to his companion in the boat. Next day they shewed it to the other man, when all the three became, for the first time, converts to the belief, that moles could swim. The animal was killed about 100 yards from the mainland, and about 50 yards from the island.

"Previous to this interesting catastrophe, molecasts had been observed on the island, and the people were at a loss to account for them. I have myself repeatedly observed

them there: and it is consistent with my own personal knowledge, that two moles have been trapped on the island within the last two years, one by our mole-catcher, and another by a son of the gardener.

"The island, since the commencement of my incumbency here, has been frequently overflown. I remember, one year, the whole surface of the island lay, for nearly twenty-four hours, under water, from one foot to eighteen inches in depth. Whether the whole race of moles then existing on the island might have shared the fate of the Antediluvians, or not, I cannot tell. It is not unlikely that a remnant (as in the days of Noah) were saved, since my friend the gardener (Alexander Duff) finds a difficulty in getting them extirpated. It is, I think, by no means improbable, that these curious animals carry on a sort of clandestine intercourse betwixt the mainland and the island.

"These few particulars, stated and authenticated as above, may serve so far to corroborate and illustrate some of your remarks on the history and habits of the *Talpa Europæa*, which I should like very much to peruse. I mentioned the above circumstances many years ago to my worthy deceased friend Mr ARTHUR BRUCE, who was some time ago secretary to the Natural History Society of Edinburgh; whether he published them or no, I have not learned *. In the mean time, if you find them of any service to you, *his utere mecum;* and believe me to be, with cordial wishes for your success in every laudable investigation,

"DEAR SIR,

"Yours sincerely,

"W. MACRITCHIE."

* Since this paper has been put to press, I find, on looking into the Transactions of the Linnean Society, vol. iii. p. 5., that a short notice of the above curious fact was sent to that Society, in 1792, by Mr BRUCE. See also SHAW's Gen. Zoology, vol. i.

Though the very interesting fact, here so well stated by Mr Macritchie, would seem to prove that the mole has an extensive range of vision, other facts appear to render this doubtful; for Mr Fletcher, to whom I have so often referred, tells me, that he has frequently thrown live moles into the water, but he never saw them on these occasions make for the land. They always swam round and round, as if they knew not where they were.

It is evident, that, if the mole had large or prominent eyes, they would be exceedingly inconvenient for it, and very liable to be injured during its operations under ground. They are, therefore, not only extremely small, but deep-seated in the head, and provided with a protecting film or integument, which the mole can bring over them, or withdraw, at pleasure. When this covering is withdrawn, which takes place when we throw a live mole into the water, the eyes may be distinctly seen like two black and shining points. Galen, in ancient times, even without the help of the microscope, did not hesitate to affirm, that the different humours of the eye of the mole, and their respective tunics, could be seen; and though Sir Thomas Brown, and others, have denied the truth of this affirmation, yet we have the fact of the existence of these humours and tunics confirmed by Dr Derham. He tells us, in his "Physico-Theology," that he had made "divers accurate dissections of the eyes of moles, with the help of microscopes, having a doubt whether what we take to be eyes were such or no; and, upon strict scrutiny, could plainly distinguish the crystalline and vitreous humours, and the ligamentum ciliare, with the atramentaceous mucus."

If a mole be taken alive, either by digging or otherwise, it usually, at first, utters a sort of small scream, or blowing noise, and prepares for defending itself by its teeth and claws. A slight blow seems sufficient to kill it. The

mole appears to be by no means tenacious of life, differing greatly, in this respect, from the class of reptiles. A mole is not easily kept alive in a state of confinement; it soon perishes, unless it can be constantly supplied with fresh damp mould in which to conceal itself. It is surprising how rapidly it will effectuate this, even on a soil that is tolerably firm. In a grass-field or plot, where the soil is light, a mole will hide itself almost in a moment; and they have been known to penetrate, and completely cover themselves in, a hard turnpike-road in the space of five minutes.

The following very curious and interesting statement concerning two that were taken alive, has been obligingly communicated to me by Mr STARK, a member of our Society.

"About four years ago," says this gentleman, "one morning early in summer, I caught a mole, which was running on the ground before me, for the purpose of shewing it alive to the children. On carrying it home in a botanical box, I put it into a large flower-pot full of moist earth in the greenhouse. It made its way instantly under the soil, and I placed a thick board over the surface of the pot, to prevent its escape. On returning, however, a short time thereafter, the board was overturned, and the mole had guttered the earthen floor of the greenhouse in many places, and was hard at work in a corner, where the earth was less consolidated. It was now replaced in the flower-pot, and another of nearly the same size inverted over it, which proved a sufficient barrier. Meantime one of the children had dug up a few worms, and the covering was removed, to see if the mole would eat them. It remained below. One or two of the worms were then drop-

ped on the surface, and in a few seconds a heaving of the earth in the pot began, and the mole peeped out its head, apparently smelling for the worms, which having caught its notice, it immediately seized one and began to eat, though without entirely leaving its hole. Finding no danger to arise from this essay, the little animal grew bolder, came up full to the surface, shook the dry dust from its glossy coat, and began to eat with great avidity the worms which were successively laid before it. While thus occupied, I stroked down its back gently with my hand. At the first touch or two it seemed a little afraid, and shewed an inclination to retreat, though it did not intermit its eating; but gaining more confidence, it allowed itself to be patted without fear, erecting its short tail like a cat, as if the smoothing of its fur gave it pleasure. Its eyes were at this time, as on all occasions when it came to the surface, open, and it seemed to use them in the selection of particular worms, when more than one were placed before it. We were much diverted with its mode of eating. When it fixed upon a worm, it seized one end in its teeth, and taking it writhing with pain between its fore-feet, it stretched out its folds by little and little as it swallowed it, by a constant action of the feet, perhaps for the double purpose of freeing the worm from soil and untwining its convolutions.

"This was in the morning. Occasional visits were made to the mole in the course of the day; and it grew so accustomed to these, that no sooner was the covering pot removed, and it heard the children's voices, than it came up to the surface for its food. Though it occasionally peeped over the edge of the flower-pot on these occasions, it did not attempt to leap from its place. Towards evening, from a desire to become still better acquainted with the little animal, it was put into a box, in which was a turf, and

the open side of the box was secured by a piece of wire-grating. The mole, however, did not relish this sort of confinement, and endeavoured to escape through the apertures of the wire. After some slight experimental attempts with its snout and fore-feet, it at length placed the latter between the perpendicular bars of wire, and turning them outwards, in the direction it employs them when digging, it inserted its sharp snout between the feet in the manner of a wedge, and, by a simultaneous exertion of its muscular force, bent the wires with great ease. The manner of its attempt struck me at the time, on account of its singular combination of mechanical powers. The insertion of its head between the feet gave it the power of a wedge, while, at the same time, it served as a fulcrum for the lateral exertion of the strength of the short limbs. It repeated this so often, when repulsed at one place going to another, that the greater part of the wires were bent; and, seeing no hope of confining it in this manner, and it having acquired the sympathy of the little spectators in its exertions for liberty, it was resolved to set the prisoner free, and to restore it to its native vale again, which was done the same night.

"Two years after, I brought home another mole one evening, in autumn; but not having the same convenience, it was placed in a large earthen jar, in the bottom of which was a quantity of dry earth. Worms were procured, and the mole fed in the same manner as before, though by candle-light. It burrowed in the earth freely, and came up for the worms which were laid down; but it was unfortunate that the earth happened to be quite dry, for, whether from this circumstance, or owing to its confinement in the jar, and being kept covered up in the atmosphere of a room, it was found dead next morning on the surface of the soil.

"The quantity of worms devoured by these moles was great, and more than I should have conceived it possible for such a small animal to eat at once. Both were apparently full grown.

"I may mention, if the circumstance be worth noticing, that the first mole had freely voided urine in the botanical box in which it was carried home."

The fate of the last of these two moles that were thus caught, and observed by Mr STARK, corroborates what I have before mentioned, with respect to the difficulty of preserving the animal alive in a state of confinement: and what he says regarding the first of them having voided urine in the botanical box, is a complete proof that the mole does not in this respect differ from other quadrupeds.

As the object of the mole, in all its operations, is to obtain supplies of food, it is not found in pure clay or sand, but in such mould as is frequented by worms, and the species seldom occurs except in cultivated countries. We do not meet with it in parched deserts, nor in the frozen regions of the north. The epithet *Europæa*, given by LINNÆUS to this species, must not be understood as indicating that it is found in Europe only, for it has been traced also in some parts of Asia and Africa. The soil of Ireland is still exempt from it, as well as from toads and serpents of all kinds. The flesh of the mole has very much of the savour of that of the rabbit, and is esteemed a great delicacy by the Arabs.

XX.—*Account of the Island of Foula.*

By Capt. Vetch, of the Corps of Royal Engineers, M.W.S. M.G.S. &c.

(*Read 18th May* 1822.)

The Island of Foula is the most western of the Shetland Islands, and, from the grandeur of its form, and secluded situation, has attached an interest to it, which a nearer inspection serves but little to diminish. As seen from the sea, at a few miles distance, its appearance is of the most imposing nature,—for though little more than three miles in its greatest dimensions, it rises boldly to a height of 1370 feet, and presents, along its western shores, perpendicular cliffs that seldom fall short of 600 feet, and in one place attain an elevation of 1230 feet, forming a scene perhaps not surpassed in grandeur by any in the British Islands. The mountain-ridge which stretches across the centre of Foula, and which chiefly characterises the island, bears some resemblance to the rock of Gibraltar. The length and height of both ridges are nearly the same; both present three prominent points or peaks, and both terminate at one extremity in perpendicular cliffs of nearly equal height.

From the summit of the Snuke, the highest and central peak of the ridge, an extensive view of Shetland is obtained. The Ossa Skerry, a remarkable detached rock, and Ronas Hill *, forming interesting features on the left of the scene, —while Fitfull Head and Fair Isle, objects of no less interest, terminate the view on the right hand, including a space of about seventy miles, chiefly occupied by the Mainland of Shetland. In very fine weather, five hills in Orkney may be descried, appearing like clouds in the horizon, but to the naked eye giving no clue to their identities. From these hills, however, the Island of Foula assumes an appearance not to be mistaken. Its precipitous west end, as seen from Westra in Orkney, at a distance of seventy miles, forms a striking object.

The Island of Foula is about fifteen miles from the nearest point of the Mainland of Shetland, and from Lerwick about thirty miles in a straight line, and in a direction nearly west: its greatest length is $3\frac{1}{2}$ miles, and greatest breadth $2\frac{1}{2}$ miles. The island is divided into two portions of nearly equal extent, by the mountainous and flat ground. Besides the mountainous ridge I have already mentioned, the Noup occurs as a detached hill in the south, rising very steeply to a height of 810 feet, and terminating in a round summit. This hill, though of the same height with Arthur's Seat, becomes a feature of minor importance in the vicinity of the Snuke. The mountain-ridge which occupies so large a portion of the island, has its general direction about 60° W. of N., being about a mile and a half long, falling very abruptly to the north, and with a gentle slope to the south, till it terminates in precipices at the coast, the external form of the mountain

* Conjectured to be a corruption from Rue-Ness Hill.

conforming in a general way with the tabulæ of the sandstone of which it is composed. An elevated platform, about 600 feet high, projects to the north from the west end of the ridge, and terminates abruptly at the north-west point of the island; and when viewed from the east, a few miles at sea, the last mentioned point, with the three peaks of the Snuke ridge, appear like separate hills rising behind each other, and then, with the Noup, may probably constitute the five hills of Foula with some, though, correctly speaking, it contains but two.

This island is chiefly composed of sandstone, resting on primary rocks; the upper 600 feet or 700 feet being of a loose texture, occasionally ferruginous, containing numerous small scales of mica dispersed through it. Pebbles of quartz, and fragments of other rocks, occur, but not frequently, and are arranged in layers and patches; the first conformable with the direction of the strata, which is also the line the patches assume in regard to each other. Green-earth also occurs in some places, in considerable quantities, in small compressed nodules, appearing, at first sight, like the fragments of a schistose rock dispersed in the sandstone. The sandstone, which occupies the upper part of the Snuke, has the direction of its strata nearly conformable with the line of the ridge, having its outgoings on the steep north slope of the hill, while it dips to the south-west, at an angle of about 12°, constituting the cliffs on the south-west side of the island, from Ravenbrag to the south point. Along that portion of the coast, from the softer nature of the rock, and the inclination of its base towards the sea, full scope is given to the action of the waves, and a scene of ruin and impending danger arrest the attention of the spectator; enormous masses, quite detached, seem ready to fall on the slightest application of force; while

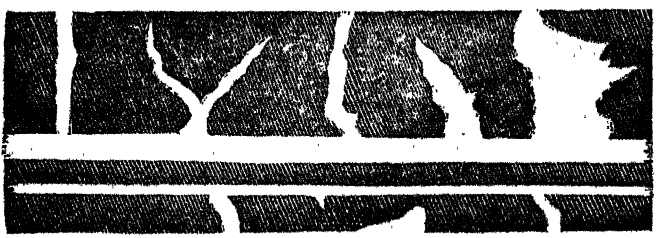
fragments, larger than the huts of Shetland, strew the shore. Among the cliffs of this shore may be seen some beautiful specimens of carious sandstone, produced by the action of the weather, the cells of great depth, and the septa of the most delicate thinness.

In descending from the Snuke ridge to the platform at the foot of Combe Hill, the sandstone then becomes more compact; and the small scales of mica, heretofore promiscuously arranged, are now disposed with thin, flat surfaces parallel to the stratification, and more or less in layers, giving the rock often a decided schistose character, when the mica is abundant,—an appearance which may also be discovered by weathering, even where the mica is scanty. As we continue to descend towards the north, the sandstone becomes still more compact, and often passes into, or alternates with, quartz rock, from which, however, the mica is rarely absent, though in some of the harder varieties it becomes again irregularly dispersed through it. At the north point of the island, opposite the Friar Rocks, we arrive at the lowest point in the regular stratification of the sandstone, proceeding from the Snuke ridge. In a small bay (marked *f* in the map), the sandstone is much undulated, and even contorted; the seams of stratification become wedge-shaped, curved, and leave the structure of the rock in an undefinable and unstratified mass. To the east and west of this point the strata again become remarkably straight, and their slaty structure well marked, differing in direction, however, on the opposite sides of the unstratified mass; that on the east side bearing 77° W. of N., while, on the west side, the direction of the strata is 105° W. of N. The Arched Friar, a singularly picturesque rock, arched in two opposite directions, and supported on four columns, I con-

jecture, belongs to the unstratified portion to which it is opposite, and to which, I imagine, it owes its ability to resist the action of the waves.

This occasional interruption of the stratification of a rock in the line of its direction, is a circumstance that deserves to be well studied. A most remarkable instance of the same kind occurs near Lambaness, in the Island of Stronsa.

Among the lower beds of the sandstone, a few thin layers of limestone occur, very compact, of a blue colour, and resembling siliceous schistus; argillaceous matter also, in combination with the mica in very thin lamina, serve occasionally to give the sandstone a schistose structure. But the circumstance most worthy of attention, is the occurrence of some thin beds of indurated clay, containing minute scales of mica; these are from a foot to two inches in thickness. The sandstone in the immediate vicinity has much the appearance of quartz-rock, and fills up numerous rents and openings of the indurated clay, which is chiefly separated by openings vertical to the plane of stratification, presenting appearances similar to what clay assumes in drying. The following sketch of a small portion will convey a notion of the manner in which it occurs, in which the white spaces represent the sandstone with its branches alternating with and traversing the clay, which forms the black parts of the figure.



Proceeding from the north point of the island to the eastward, the strata have their direction 77° W. of N.; when two-thirds across the open bay, the sandstone begins to rise towards the promontory (B), its direction and dip bending round at right angles to their former bearing. Its rise towards B is at first very gentle; but near the point (*a*) the dip rapidly assumes an angle of 70°, where a small gully divides the sandstone from the primary rocks; and, on the east side of the gully, an apparent chaos of primitive rocks meets the eye; thick tortuous beds or veins of graphic granite intersect gneiss and mica-slate in the most fantastic manner; and veins or beds of quartz, of a calcedonic appearance, of a foot and more in thickness, tend to increase the variety. An attentive examination, however, shews, that the gneiss and mica-slate, and even the granite veins, have a general tendency to one direction and dip; and a view of the east side of the rock A, which accompanies this description, will shew the nature of the association. The dip is a little to the E. of S. The granite veins, however, are not always parallel with the dip of the strata; on the contrary, as is seen in the section of the rock A, they sometimes intersect them at right angles. I observed in one place a section, in the direction of the stratification, display two curved veins of granite, inclosing a portion of mica-slate.

At the promontory B, the mica-slate contains much hornblende, and in some places is studded with garnets. Felspar occurs also between the layers, by which means it passes into gneiss, to which it seems subordinate. On the east side of the promontory B, all appearance of gneiss and mica-slate is lost, and an unstratified mass of fine-grained graphic granite extends for half a mile along the coast to the point C. This granite is of the same nature with the veins already mentioned; the felspar, which is in excess,

is sometimes nearly compact, and so abundant, as, without its geological connections, would render the name of granite rather inapplicable *. At the point C, the unstratified rock terminates, and a narrow cave or fissure at that place prevents an inspection of its contact with the succeeding rocks. On the south side of the fissure, at (C), gneiss rocks occur, dipping to 25° (S. of E.), at an angle of 45°, and extend for a space of a mile and a half to (*d*), varying or curving in the direction of the strata, the most general being the magnetic north, nearly at right angles to the general dip of the sandstone. Subordinate to the gneiss occur beds of mica-slate, hornblende-slate, and compact felspar, and occasionally veins of large-granular granite present themselves. The junction, near the point *d*, of the sandstone and gneiss is effected by gradations so minute, as to render it difficult to point out the precise spot, affording a remarkable contrast with the junction of these rocks at the north end of the island. At the point *e*, a bed of unstratified quartzose rock occurs, apparently bending up the strata of the superimposed sandstone. Among the primary rocks of Foula, minute crystals of iron and copper pyrites often occur disseminated.

The distinction of Primary and Secondary rocks in this island may be rather comparative than real; for, though the sandstone occasionally partakes both of the character of primary sandstone and quartz-rock, it also alternates with, and at last passes into, sandstone of a much newer aspect. The Transition class, in this instance, seems a very convenient division to refer it to.

* The nature and connections of this granite are somewhat similar to those of Ronas Hill and Ben Layel.

The lines drawn on the map, distinguishing the boundaries of the different rocks, are in a great measure conjectural, as the surface has there a deep covering of peat-moss, and the only clue is that afforded by the direction of these lines as they occur at the coast; but as their extent is small, the direction and length assigned to them cannot differ much from the truth.

The Island of Foula, except on the very steep acclivities, is covered with peat-moss to a considerable depth; and the circumstance of laying waste the country, for the purposes of fuel and roofing, which so constantly distresses the eye in Orkney, is here almost rendered impossible. At Stanisfield, however, a portion of the Noup Hill, the covering of peat-moss being scanty, the natives have managed by perseverance to get down to the naked rock; and they seem disposed to prevent an accumulation of soil again in that place, as I observed some of them employed in cutting for fuel the scattered tufts, the remains of former attacks. This system of carrying off the soil, so prevalent in Orkney and Fair Isle, cannot be sufficiently deprecated, or too soon put an end to, as hundreds of acres of good land are every year consigned to sterility, though abundance of peat-moss is never far distant. Along the margins of the brooks in Foula, white and red clover, of natural growth, appear in considerable luxuriance; and should Mr Leisk, the worthy proprietor of Uya, be able to draw the attention of the Shetland proprietors to pasture, instead of cornfields, Foula may, after no great lapse of time, present over its greater extent rich crops of grass, instead of the heath and scanty herbage it at present affords.

The number of inhabitants in Foula amounts to about 165. And it is a curious fact, that during the last seven years there has been no marriage in the island, nor illegitimate children;—in this respect affording an extra-

ordinary contrast to the state of Fair Isle. Nor does the contrast end there. In Fair Isle, the natives are in general half-starved and ill-clothed, seem squalid and unhealthy, and have a look of savage apathy. In Foula, the reverse is the case: in every respect the inhabitants seem to be much at their ease, are decently clothed, and are of a cheerful, inquisitive character. Indeed, I met no peasantry in Shetland that equal them. Their frank, free disposition, simple primitive manners, render them a very amiable people. It seems difficult to account for the difference between the inhabitants of two small islands so near, and in every respect so similarly situate. The difficulty entirely ceases, however, when it is known that the Fair Islanders live principally by smuggling, and the Foulaese by fishing: much may also be due to the exertions of the proprietor of the island, Mr Scott.

Our arrival in Foula, to carry on there the operations of the Trigonometrical Survey, excited the wonder of the Foulaese very much; they never ceased to express their admiration of the marquees and tents, and other objects of novelty. But when they understood our intention of carrying our baggage to the summit of the Snuke, and living among the bonxies, they considered the attempt would be fruitless and rash. An elderly man, looking at the great theodolite in its case, exclaimed, "It's a bonny box; but it's no in the poor o' man to take that up the Snuke." When, however, they saw our lusty artillerymen set off with heavy packages up the steep ascent of Snifield, a kind of emulation seized them, and we were enabled to hire about twenty of them, on easy terms, to assist; and the same evening we had an encampment of eight tents on the Snuke. A respectable old woman, who seemed to pay great respect to the Hill Trows, gave us her blessing at parting, assured, that if we were really going to live among the

bonxies, we should never return safe again. The men, too, feared "the bonny claith-houses would never stand the north winters." The news from the metropolis arrives in Foula a few months after date, a good deal changed in its course northward, but more adapted to the ideas of the Foulaese. I was seriously asked if it was true the King was coming to Foula.

The name of Foula being supposed by some to have been imposed from the quanity of fowl that inhabit it, in a description of the island, some notice of these may be given; and, though ill qualified for the task, I shall state some particulars relating to such of the feathered tribes as particularly distinguish Foula, and shall therefore commence with the Bonxie, or Skua Gull, the *Lestris cataractes* of naturalists.

This bird, I believe, in the British Islands, breeds only in Shetland, and there only on three hills, the Snuke, Ronas, and Saxafiord, which are also the three highest. On Foula they seem to have taken exclusive possession of the Snuke. In its nature it appears to partake both of the nature of the gull and eagle tribes. On Foula, it breeds generally about a height of 1300 feet, and nowhere but on the Snuke. It is easily tamed, and is, I understand, a very docile bird *. I often observed it walking about within a few yards of the tent, and without fearing our approach. When, however, his nest is approached, he shews a determination to defend his possession with his life. Ravens, eagles, hawks, or other birds, are soon

* A young one, which I kept for some time, and afterwards sent to Mr Neill, Canonmills, near Edinburgh, has proved remarkably docile. It is now (May 1822) acquiring new plumage, which has every resemblance to that of the mature bird.

pursued from the territory they inhabit. On approaching the nest, an attack instantly commences; male and female in rapid succession descend from a considerable height, with a velocity and noise truly startling; horses, cattle, and sheep, are immediately put to flight, and receive no intermission of attack till well driven from the nest; and if man, bent on sinister purposes, continues to brave the bonxie's fury, he will seldom accomplish his aim without carrying away marks of war. The nest is a mere concavity in the ground; the number of eggs two; the month of breeding July. The young bird is a nimble, gallant little animal, and almost as soon as hatched leaves the nest. On the approach of danger he secrets himself in holes, or behind stones, with great art; and when captured, at last makes a shew of defence that is quite amusing. The number of these birds that annually breed at Foula probably does not exceed thirty pair.

The Arctic Gull (*Lestris parasiticus*) deserves the next place in the description of the birds of Foula. This elegant bird, which I have observed in Orkney to breed in single pairs, or at most in two or three pairs in one place, seems to have selected Foula for its head-quarters, and here it is chiefly congregated on the elevated platform under Combe Hill. Solitary pairs may be found in other places; but at the place above mentioned, the number of pairs breeding in 1821 probably did not fall short of 100; and having established that as the seat of power, they are no less tenacious of this domain than the bonxie, from which they exclude all other birds. And the Skua, when it happens to stray into the adjoining territory, is pursued by such a host of nimble enemies, as often leave him no resource but to alight, when the tactic of the Arctic gull is lost; his long wings, so advantageous to him on the wing, being quite the reverse

on the ground. They are equally fierce with the bonxie in the defence of their nest, and make up in superior velocity their deficiency of weight. The rushing noise that accompanies the darting resembles that of a small rocket. The Arctic gull employs the same stratagems with the plover to decoy enemies from its nest. Placing itself at some distance from its retreat, it assumes the appearance of being disabled and incapable of flying, even making repeated tumbles, and continues to excite pursuit in a direction opposite to that of its nest, till a safe distance is obtained; the Arctic gull then mounts with extraordinary velocity: and I may venture to say, that, to a person ignorant of the trick, the stratagem is conducted with an art that never fails of success.

In approaching the nest of the Arctic gull, an attack still more fierce than that of the Skua commences. The intruder receives constant flaps with the wings of the bird. Judging from the rapidity of the dart, and their just grazing the head of the person, I imagined, if any hard substance was suddenly elevated above the head a few inches at the moment previous to the graze, the animal would probably terminate its existence against it. I accordingly elevated the muzzle of a fowling-piece a few inches above my head, and after a few trials, in which the bird shewed a most extraordinary power of altering its course when almost touching the gun, the experiment ended by its death; and so great was the force with which it struck the gun, that its brains were forced out, and the death was instantaneous; and I have no doubt an adroit person might kill numbers in this way. The form of the nest, number, colour, and shape of the eggs, resemble that of the Skua, as also the time of breeding. The young birds, or scories, are of a very handsome dark-speckled brown; the old birds are

generally of a blackish colour all over, with exception of the belly, which is of a rusty or tarnished appearance. Considerable numbers, however, appear with white bellies, and a few variously speckled on the breast, forming a gradation between those with black and those with white bellies. These varieties of colour, I imagine, are the effect of different ages, having observed pairs belonging to the same nest associated in every possible mode of combining the colours, as two whites, two blacks, a white and black, a white and speckled, and a black speckled, and two speckled. I should imagine that not less than 150 pairs breed in Foula.

The Kittiwake Gull (*Larus rissa*), from their numbers, are next in importance, and are remarkable in their adopting a very peculiar and circumscribed place of breeding; they are all congregated in a natural arch, with which the north-west point of the cliff of Foula is perforated. It seems a habit of this bird to prefer covered places of breeding, and the number that crowd into the arch is so great as to completely whiten the face of the rock, and where the fowler, if he is disposed, may destroy them by bushels.

The Puffin (*Alca arctica*) breeds in great numbers on all the high cliffs of Foula, and their number probably exceeds that of all the other birds put together.

That well known bird of the sailors, Mother Cary's Chicken (*Procellaria pelagica*), conceived by many of them to breed under the sea, and never to alight on land, breeds in Foula in considerable numbers; and an abundant supply, both of old live birds and young ones, or eggs, may be obtained from the boys of Foula for a very trifling reward. The eggs are of a dull-white colour, and very round at both ends.

Ravens are in considerable numbers in Foula, and I observed them more numerous on one high cliff of great

height, which I have named Raven Crag in the map, though probably it has a native name attached to it, few features of the island being without them; but probably the omission of native names to minute parts will not be regretted, as many of them can only be pronounced by a native, of which the Snuke is an instance, as it is somewhat difficult to say whether the concluding consonant should be *k*, *g*, or *d*, though I think the *k* comes considerably the nearest.

I saw some Eagles, but am informed they do not breed on Foula at present.

The Sea-pie, or Oyster-catcher, occurs in considerable numbers in Foula along the low shores; as also the small Guillemot, and the Danish Duck. Of Plovers and Curlews, so plentiful in other isles of Shetland, I did not observe an individual; and I was told the appearance of curlews on the coast of Foula was a sure indication of an approaching storm.

Seals are abundant on the coast of Foula in the month of July, both of the large and small species; the place of resort seems chiefly to be under the high cliffs between the Combe and the Kittiwake Walk. I imagine I saw not less than forty in one day.

The curiosities of Foula, chiefly detailed by the natives, are, I am afraid, no longer to be found. The carbuncle, seen by boatmen under the high cliffs of Combe Hill, is not confined to Foula, as the same phenomenon is said to occur off Hoy.

I regret I did not examine the Lum of Snifield, a crevice near the summit of the peak of that name, which the natives allege descends perpendicularly to the level of the sea (1130 feet), and then to have a subterranean passage to the ocean. Of the truth of which, they adduce the circumstance of a dog pursuing a sheep, which precipitated itself into the crevice, and was followed by the dog, and both

were found afterwards at the mouth of a small cave by the coast. It would, however, appear at present, if the natives did not impose on some of our party, that the lum has ceased to exist, as they could discover nothing but loose stones filling the heretofore unfathomable abyss.

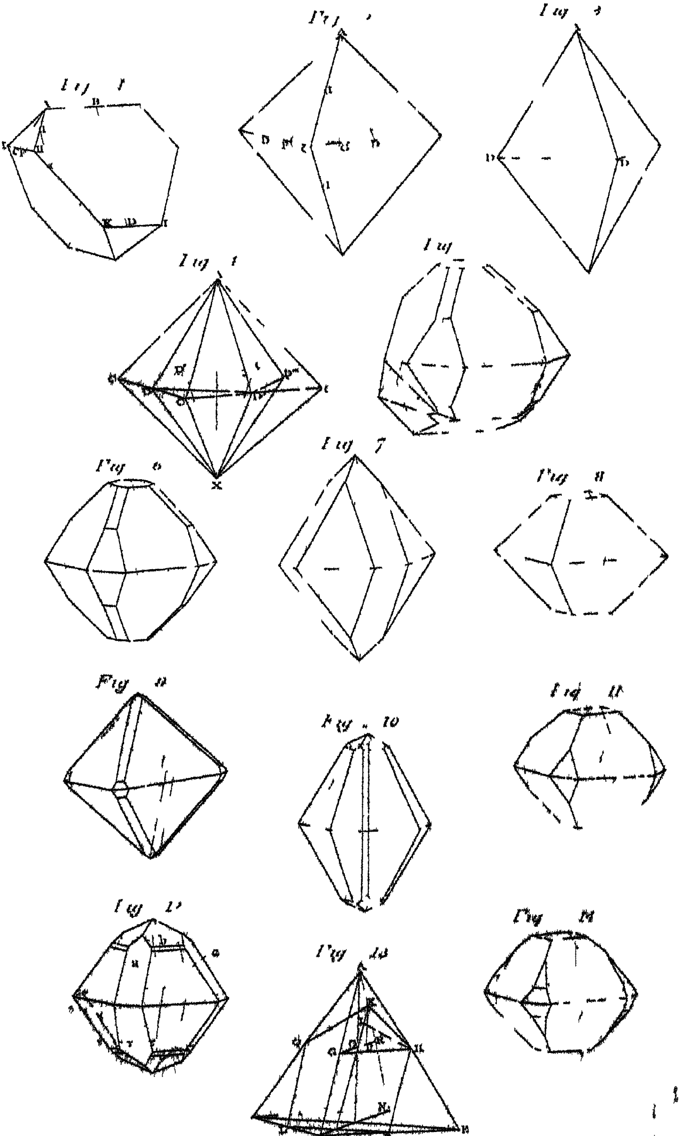
The following is a register of the weather in the month of July, on the summit of Foula, or about 1340 feet above the level of the sea.

Register of the Weather on the Snuke Hill of Foula, July 1821.

Sign — signifies before noon, and sign + after noon.

Days.	Hours	Barom.	Ther.	Ther.	General Remarks.
8	+11			41	High north wind, and fog.
9	+12			38	Light do., very foggy, with showers.
10	$+10\frac{1}{2}$			39	Fresh do., fog clearing away.
11	$+2\frac{3}{4}$	28,8	$48\frac{3}{4}$	$48\frac{1}{2}$	
	+11			43	
12	— 8	28,737	$47\frac{1}{2}$	46	Calm.
13	+ 2	28,523	$48\frac{1}{2}$	46	Calm.
15	$-10\frac{1}{2}$	28,488	49	49	Calm. Foggy. Wind S.
	+11			42	
16	— 8	28,297	48	46	Wind W. A gale, with fog.
17	— 6	28,275	44	45	
18	$-9\frac{1}{2}$	28,755	$49\frac{1}{2}$	48	Wind S. A gale, and thick fog.
	+11	28,848	50	49	
19	$-7\frac{3}{4}$	28,824	52	$50\frac{1}{2}$	Wind S. Moderate. Flying mists.
	+10	28,667	$49\frac{1}{2}$	$49\frac{1}{2}$	Wind S. with fog. Blowing.
20	— 9	28,505	51	$50\frac{1}{2}$	Wind S. Fog on hill.
	$+10\frac{1}{2}$	28,310	50	48	Wind S. Fresh, with showers.
21	— 4	28,133	$50\frac{1}{2}$		Wind S. with fogs.
	— 8	28,118	52	$50\frac{1}{2}$	Do. do.
	+12	28,170	$53\frac{1}{2}$	48	Do. do.
22	— 8	28,242	56	52	Clear, calm weather.
23	— 8	27,982	52	52	Wind SE. Thick fog down to shore.
24	— 8	28,046	50	50	Wind ESE. Fog.
	$+3\frac{1}{2}$		55	55	Wind SE. Fog.
	+11	28,058	48	48	Do. do.
25	— 8	28,087	$50\frac{1}{2}$	50	Do. do.
	+12	28,092	$48\frac{1}{2}$	47	Clear on hill, haze in the distance.
26	— 8	28,122	$53\frac{1}{2}$	54	Calm. Clear on hill.
	+11	28,206	48	48	Do. do.
27	— 8	[illegible]	52	52	Calm, clear. W. wind about 9.
	+11	28,277	[illegible]	45	Wind W. by N. Showers.
28	— 8	28,282	$49\frac{1}{2}$	48	Do. do.
	$+8\frac{1}{2}$	28,238	$48\frac{1}{2}$	$47\frac{1}{2}$	Wind W. do.
	+11	28,228	$44\frac{1}{2}$	48	Calm.
29	— 8	28,306	50	48	Wind NE. (light). Clear.
	+11	28,362	47	46	Calm.
30	— 4	28,320	$44\frac{1}{2}$	48	Wind SE. (light). Clear.
	— 8	28,320	52	50	Do. do.

PLATE I



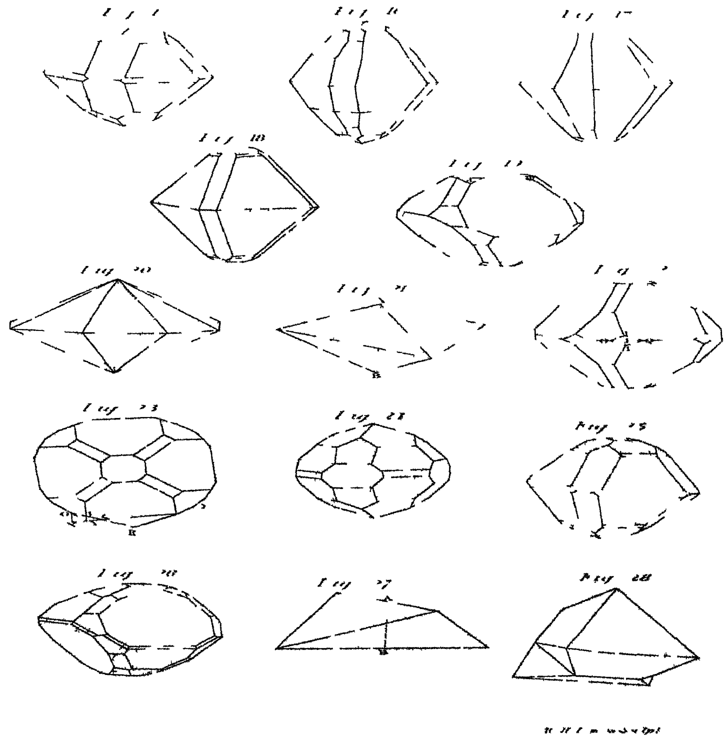


Fig. 18
Fig. 28

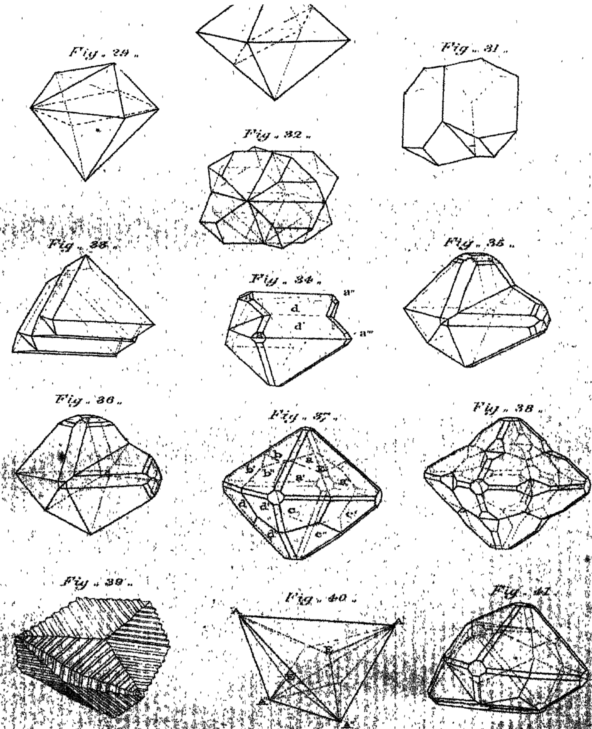


Fig. 29.
Fig. 31.
Fig. 32.
Fig. 33.
Fig. 34.
Fig. 35.
Fig. 36.
Fig. 37.
Fig. 38.
Fig. 39.
Fig. 40.
Fig. 41.

PLATE IV

Fig. 1

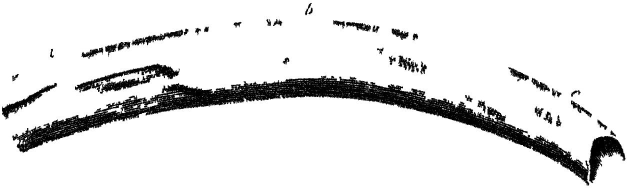


Fig. 2

SECTION

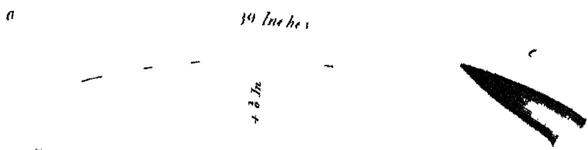
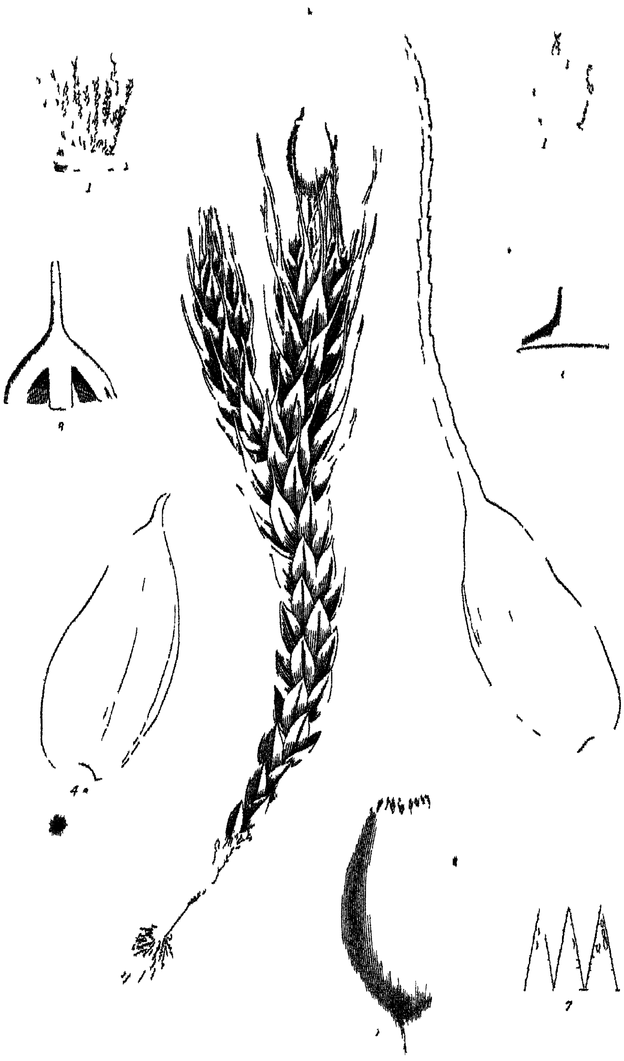


Fig. 3

PLATE X

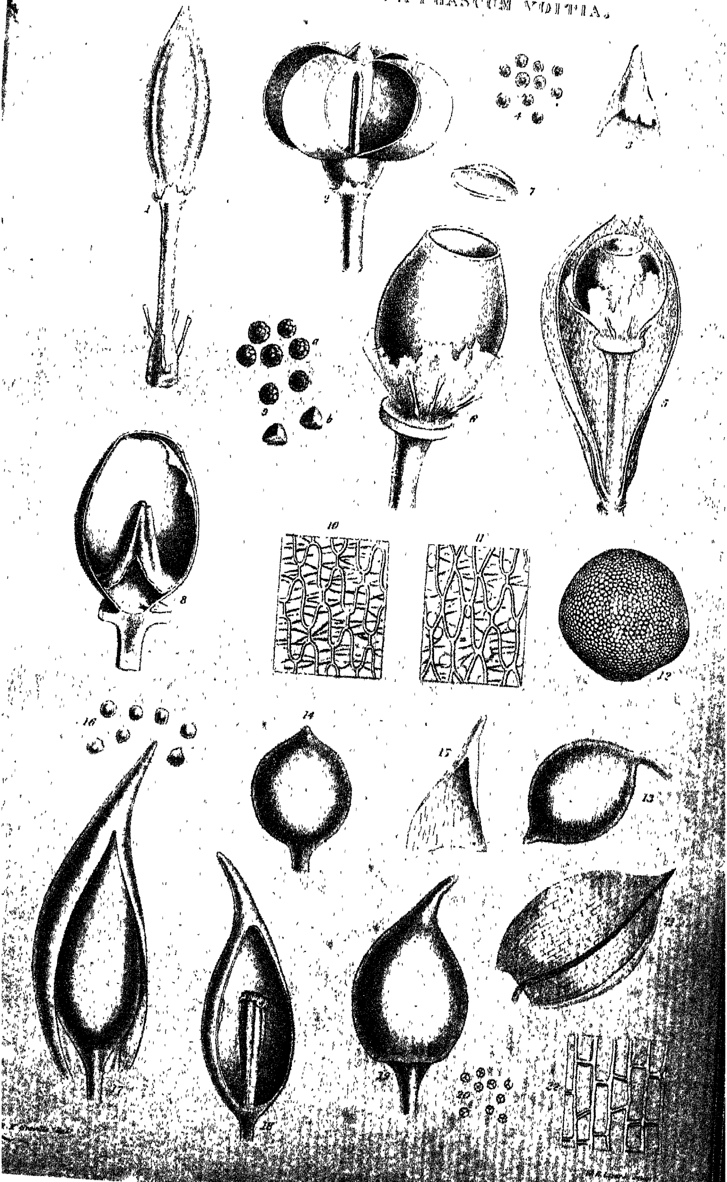
PLATE VI



GRIMMIA LEUCOPHAEA

PLATE VII.

ANDREA. SPHAGNUM. PHASCUM. VOITIA.



GLOIONEMA APICULATA. ECHINELLA CIRCULARIS.


ISLAND
OF
FOULA.
Landing Place

[illegible] Bearing S.W. by [illegible]

[illegible]

MEMOIRS

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FOR THE YEARS 1821–22–23.

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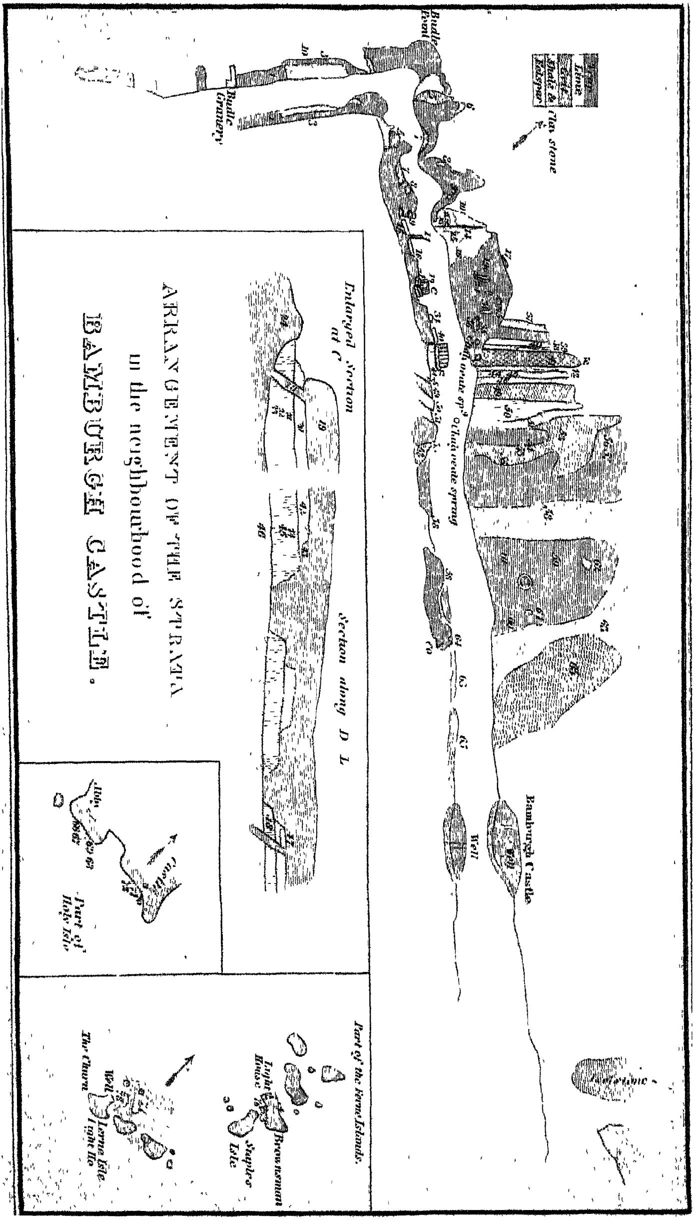
ADVERTISEMENT.

In laying its Memoirs before the Public, this Society does not hold itself as responsible for the facts or opinions which may be advanced on the various topics of Natural History that are discussed. These, accordingly, must be distinctly understood as resting entirely on the individual authority of the respective Writers who have favoured the Society with Communications.

The Council of the Wernerian Natural History Society, *in order to meet the wishes of Authors of Communications, whose views and discoveries may be anticipated by delay in the publication of the Memoirs, have resolved that, in future, the Parts shall be published half-yearly, and that they shall be limited to the size and price of the present volume.*

May 1823.


ARRANGEMENT OF THE STRATA
in the neighbourhood of
BAMBURGH CASTLE.
Enlarged Section at C
Section along D L
Part of Holy Isle
Part of the Ferne Islands.
Bamburgh Castle
Well
Budle Point
Budle Granery
Clay stone
Trap
Lime
Grit
Shale &c
Kelspar
Whitewale spring
Staples Isle
Brownsmount
Light House
Ferne Isle
Light Ho
The Church
Well
Castle

XXI.—*Sketch of the Geognosy of Part of the Coast of Northumberland.*

By W. C. Trevelyan, Esq. M. W. S.

(*Read* 16*th November* 1822.)

THAT part of the coast of Northumberland of which I shall attempt to give a short account, extends from Budle Granery to Iselstone, south of Bamburgh, and is about three miles in length.

A little west of the Granery is a trap dike or vein, about six feet wide; beyond which are alternations of lime, sandstone, and shale. In the superincumbent earth are large angular masses of a red limestone, containing madrepores, and other organic remains.

East of the Granery, we meet with a bed of trap, which contains small particles of iron-pyrites, calcareous spar, and quartz. About half-way between the Granery and Budle Point, a distance of about half a mile, a bed of limestone occurs, resting on the trap. The shore, extending from Budle Granery to this point, is at times covered with a sand of a beautiful appearance, which contains iron (attracted by the magnet), garnets, and perhaps iserine.

At the spot marked (4.) in the map*, the rock first rises much above the level of the sand, being there about eight or ten feet in height. Here some small masses of compact felspar are imbedded in the trap. After some distance, a limestone again occurs, but *under* the trap, and on it a sandstone (5); against the south side of which the trap rests, and in some parts lies upon the grit, gradually terminating in a thin edge. The two rocks may in several places be found adhering firmly to each other. A small mass of crystalline limestone projects from under the trap near this place, and on the surface of the latter is a bed of grit, pieces of which may also be observed imbedded in that rock, and also a fragment of an impure limestone (8). The trap here gradually rises inland, forms a high hill, which is part of a range extending to Spindlestone, about two miles from the coast, where it forms lofty, picturesque cliffs, in their structure approaching the columnar: the name appears to be derived from some insulated irregular columns which project from the mass.

A bed of limestone next occurs, about two feet thick, lying on the trap. Where in contact with that rock its appearance is very crystalline, and as it recedes from it, it gradually loses that feature. A vein of trap is here seen, generally three feet wide, cutting through the limestone; and from it run many veins, from two inches, to half an inch, and still less, in width, and many yards in length, to which the limestone may be observed adhering.

Near the spot marked 16, a vein of heavy-spar occurs in the limestone. At 17, a mass of fine-grained sandstone projects from below the trap.

After passing some distance over the trap, a curious appearance is seen in a basin-shaped depression: a bed of

* Plate XI.

limestone about three feet thick (in which is the same gradation to a crystalline appearance, as mentioned above) rests on the trap (here containing many minute particles of iron-pyrites); on the limestone is a shale, about eighteen inches thick, containing vegetable remains; and on it another trap, approaching to columnar in its structure, about eight feet high: a vein of the same substance connects the upper and lower beds of that rock, passing through the shale and limestone.

Beyond this, we meet with a small imbedded mass of coarse grit (25), a portion of a thin bed of limestone lying on, and a mass of the same substance imbedded in the trap: together with portions of trap, with much imbedded quartz, of impure compact felspar, and of felspar inclining to jasper.

At 35, 36, are a bed of fine sandstone and of limestone, under the trap.

At 37, is a clay slightly inclining to wacke, below the trap, and which appears to be part of the same bed as occurs again at 46 and 58. 39 is a bed of trap, with compact felspar, on which rests a columnar trap; and under it is a shale and a limestone about eighteen inches thick, below which the trap occurs resting on 37.

The section C D shews one of the most curious appearances in this tract; the columnar trap, from seven to twelve feet high, rests in part on a shale (42) about two feet thick, below which is a bed of trap (43) about one inch thick.

From this the columnar rock descends to a limestone about four feet in thickness, and from thence to 46, a bed resembling 37, mentioned above. In one part, a vein of trap, connected with the upper columnar rock, passes through these three beds, which, near it, appear much altered.

Leaving this spot, we pass over a thick bed of sandstone,

a limestone, and a shale, all highly inclined. The latter rest on a mass of trap (apparently a vein), which terminates very suddenly. 53 is a highly indurated quartzy sandstone; between it and the basalt are veins of calcareous spar, pyrites, and heavy-spar. Passing over another bed of grit, we come to a trap, which reposes on a shale. The next bed of this rock (59) contains large nodules of iron-pyrites, very compact quartz, calcareous and pearl spar, drusy cavities lined with quartz-crystals, and crystals and veins of iron-glance, and perhaps of titanium; and also masses of chert or splintery hornstone, of a bluish-grey colour. In this part are also some included portions of shale and limestone.

We afterwards pass a bed of shale and of grit, and then the sand prevents any further observations, until we arrive at Bamburgh Castle, which is seated on an eminence of columnar trap. In the large square tower of this ancient building is a well, supposed to be of Roman work, sunk to the depth of 150 feet, 75 feet of which are through trap, and the remainder through a freestone. The junction of the two beds is visible in several parts of the hill; they are sometimes separated by a thin bed of ruddle or iron-clay.

The next appearance of any rock is at Iselstone, about a mile south of Bamburgh (a reef of rocks so called), where, at low-water, appears a large extent of trap, and a few yards south of it, a bed of limestone.

This is the last appearance of this rock to the south for several miles, the next being a dike or vein at Beadnell, described in the fourth volume of the Transactions of the Geological Society.

The next and only appearance of trap, on the coast north of Bamburgh, is at Lindisfarne, or Holy Island, where it appears to be part of a dike or vein, probably connected with one which crosses the north road near Kylse, about

four miles west of Holy Isle. At the latter place, near the Abbey, the trap may be seen in some parts cutting through, in others resting on, or inclosing, the limestone and shale, which, when in contact with it, are much altered in their appearance. A coarse limestone appears to crop out from below the trap, near the Castle.

The remainder of Holy Island consists of alternations of limestone, grit, coal, and shale. The seam of coal is seventeen or eighteen inches thick, and was worked for a short time, but given up, on account of the quantity of water which oozed in from the sea: the pits were towards the north-west end of the Island. Small quantities of galena have also been found here.

The Ferne Islands, or Staples, which at high water are between twenty and thirty in number, are many of them connected at low-water (in which state they are represented in the plan) so as to form only about thirteen. They appear to consist principally of a hard coarse trap, inclining to columnar, which in some of them rises to the height of nearly 100 feet above low-water mark. The steep sides generally face the south or south-west, and on the other side they slope gradually to a level with the sea. The same observation may also be made with regard to the basaltic eminences on the opposite coast, and those more inland.

At 74, is a mass of limestone four or five feet thick, surrounded with trap. 75, a limestone, and compact felspar. At 77, large, loose, angular blocks of felspar passing into claystone. 78, a bed of limestone, about five feet thick.

In a vault of a tower, on the north end of the Ferne Island, is a well in the trap, now filled up with rubbish.

Towards the north-west point a fissure proceeds some yards between two rocks, through which, in storms from that quarter, the sea is driven with great violence, and

forms a beautiful *jet d'eau*, frequently sixty feet high, known on the coast by the name of the Churn.

Many of the appearances described in this sketch, and represented in the plan, can only be observed at low water.

List of Specimens illustrative of the preceding Sketch, presented to the Wernerian Society.

The numbers correspond to the spots from whence the specimens were taken, as represented in the Plan.

NEAR BAMBURGH.

1. Trap, near Budle Granery.
2. Nodule of Quartz, in do.
3. Trap under the Limestone near the Granery.
4. Impure compact Felspar, in Trap.
5. Junction of Sandstone and Trap.
6. A. Limestone at a distance from the Trap.
6 B. ——— near the Trap.
7. Sandstone above the Trap.
8. Impure Limestone in Trap.
9. Sandstone in Trap.
10. Sand, containing Iron, Garnets, and perhaps Iserine.
11. Limestone in contact with the Trap.
12. ——— two feet above the Trap.
13. ——— one foot above the Trap.
14. From a Trap-vein in Limestone.
15. The Surface of the Trap under the Limestone.
16. A Vein of Heavy-Spar in Limestone.
17. Fine-grained Sandstone under Trap.

18. Part of Trap-vein three inches thick, passing through a bed of Limestone and Shale, and connecting two Trap beds.
19. The upper bed of Trap, mentioned at 18.
20. Shale under 19.
21. Limestone farthest removed from the Trap, and under 20.
22. ——— eighteen inches from the Trap.
23. ——— next the Trap.
24. The lower bed of Trap, in which many minute particles of Iron-pyrites are disseminated.
25. From a small mass of coarse Grit, imbedded in the Trap.
26. From a small mass of Limestone in the Trap.

27. Trap with imbedded Quartz and Carbonate of Lime. 28. Trap with Carbonate of Lime. 29. Impure compact Felspar. 30. Trap with Quartz. 31. 32. Felspar inclining to Jasper.	Forming small beds on the surface of the Trap, No. 24.

34. Limestone imbedded in Trap.
35. Fine Sandstone under Trap.
36. Limestone between 35, and Trap.
37. Clay slightly inclining to Wacke, under Trap.
38. Shale, under columnar Trap.
39. Trap, with compact Felspar.
40. Limestone under 38.
41. Quartz intimately combined with Felspar, on surface of the Trap bed.
42. Shale, on which the Trap rests.
43. Greenstone between 42 and 44; entire thickness of the bed, is shewn by the specimen.
44. Upper part of the Limestone under 43.
45. Central part of do.
46. Clay inclining to Wacke.

47. Quartz and Felspar, a bed between the Trap and Limestone 48.
48. Limestone.
49. Grit under 46.
50. Limestone under 49.
51. Shale under 50.
52. Sandstone.
53. Hard Quartzy Sandstone in contact with Trap.
54. Veins of Calcareous and Heavy Spar, and Iron-pyrites, in 52 and 53.
55. Crystals of Carbonate of Lime in 53.
56. Calcareous Spar in veins in the Trap.
57. Green Earth in do.
58. Trap in junction with Shale.
59. Amygdaloidal Trap.
60. Iron-glance in veins in the Trap.
61. ——— in crystals, with Quartz-crystals in cavities in Trap.
62. Shale, in the Trap.
63. From a bed of Shale.
64. Limestone imbedded in the Trap.
65. Sandstone.

HOLY ISLAND.

66. Limestone in contact with the Trap.
67. ——— at some distance from the Trap.
68. Shale at some distance from the Trap.
69. —— in contact with the Trap.
70. Limestone, a bed, apparently under the Trap.
71. ——— in the Trap.
72. ——— apparently under the Trap.

FERNE ISLANDS.

73. Trap of Ferne Islands.
74. Limestone in Trap.
75. Do., part of a bed.
76. Compact Felspar, above 75.
77. Felspar passing into Claystone.
78. A bed of Limestone.
80. Red Limestone occurring in Bundle Bay.

The Limestones near the Trap are generally highly phosphorescent when put in a coarse powder on a heated iron.

XXII.—*On the Fossil Remains of Quadrupeds, &c. discovered in the Cavern at Kirkdale, in Yorkshire, and in other Cavities or Seams in Limestone Rocks.*

By the Rev. GEORGE YOUNG, A. M.,
Corresponding Member of the Wernerian Natural History Society.

(*Read 4th May* 1822.)

THE existence of the bones of quadrupeds in several caves in Germany, in the fissures of the Rock of Gibraltar, and in cavities in limestone-rocks in various parts of the shores of the Mediterranean, has long been known to the literary world; but it is only within these few years that similar collections of animal remains have been discovered in the limestone-rocks of Britain. These collections are highly interesting, as they consist chiefly of the bones and teeth of animals belonging to warmer regions, and not known to have been natives of Britain, at the most distant era to which our history reaches. It is not the object of this paper, to notice all the collections of this kind hitherto discovered in England; but to describe some phenomena of this class which have fallen under the observation of the

writer. Some part of what he has to state, has already appeared in a more ample form, in the Geological Survey of the Yorkshire Coast, just published; and more may be found in a paper lately communicated to the Royal Society by Professor Buckland, which is expected to make its appearance in a few weeks: yet several of the following particulars have been ascertained since the descriptions now referred to were drawn up.

The opening of the cavern at Kirkdale, near Kirkby Moorside, in Yorkshire, which occurred in July 1821, has brought to light the most singular deposit of such animal remains hitherto observed; for though the caves of Gaylenreuth in Germany, and some in other parts of the Continent, present much larger accumulations of bones and teeth, the relics entombed at Kirkdale surpass them all in point of variety. Here were found the teeth and bones of the elephant, the rhinoceros, the hippopotamus, the horse, the ox, the elk or stag, the hyena, the wolf, the bear, the tiger, the fox, and the rat; and of some other animals, both large and small, not yet ascertained. Some of the larger teeth have been assigned, in the Geological Survey, to the *Palæotherium magnum*, as they appeared to correspond exactly with Mr Parkinson's description of the teeth of that extinct animal; but the author has found that they belong to the lower jaw of the Rhinoceros. The most remarkable specimen not yet identified, is that figured in the Geological Survey, Plate xvii., No. 11., from the collection of the Reverend Jos. Smyth, A. B. of Kirkby Moorside. A correct model of that specimen, executed by Mr Bird of Whitby, is now presented to the Wernerian Society.

Along with the bones of quadrupeds, there were discovered a few bones of fowls. The specimen given in the Geological Survey, Plate xvii., Fig. 3., seems to be a wing-

bone of a goose, or large duck; and Professor BUCKLAND has wing-bones of a raven and a large pigeon, distinctly characterised.

The cavern, which is minutely described in the Geological Survey, p. 271, &c. is a long and narrow opening in the oolite limestone, on the banks of Hodgbeck, scarcely a hundred yards to the south-east of Kirkdale Church, and about a furlong from the place where the strata, which gently dip toward the south, sink under the deep alluvium of the Vale of Pickering. The opening was discovered by some workmen employed in quarrying the rock, on the side of the bank, where the broken edges of the strata are covered with alluvium, forming a slope rather steep. The entrance is about 100 feet distant from the *beck* or rivulet, 36 feet above its level, and 30 feet below the level of the top of the bank above the quarry. It has been traced inward, in a direction nearly horizontal, above 250 feet, including 45 feet laid open by the operation of quarrying. The breadth of this aperture varies from two or three feet to six or seven. In two places, the height is such as to allow persons to stand upright; in some other parts, we may walk stooping; but in most places, it is necessary to walk on our hands and knees; and in some spots, the roof is so low, that there is no passage but by crawling along the ground.

Some parts of the cave present obvious marks of fracture and dislocation; and it is traversed by cross fissures in various directions. Yet it is not a mere fissure in the rock, as is evident from the want of correspondence between the opposite sides, and from the existence of a number of rounded hollows or depressions, appearing in the sides, the floor, and even the roof; resembling such water-worn hollows as we see in rocks in the beds of rivers, or on the shores of the ocean. The roof is for the most part quite solid, and

where cracks appear, they are far too narrow to have admitted the contents of the cavern to have entered by them. It is difficult, however, to make proper observations on the interior surface, for it is almost every where covered with a crust of stalactite; pillars of which, at the opening of the cavern, were found hanging down like icicles from the roof, completely obstructing the passage in several parts, till they were removed. Quantities of the same calcareous matter covered the floor here and there, in the form of stalagmite; and this, in some places, was collected in the rounded cavities of the floor, each forming a small section of a sphere, resembling a cake of bees' wax, having one side flat, and the other rounded.

Along the bottom of the cave, there was also found, in most places, a soft mud, or marly clay, varying in depth from an inch to four or five inches; and where the stalagmite prevailed, the surface of the mud was glazed over with it. In this mud, or clay, the teeth and bones were principally met with; and the greater part of them, particularly of the larger bones, occurred in a broad part of the cave, about forty feet from the original entrance, and just before the present entrance.

It is of importance to observe, that the original entrance was of very small dimensions, not exceeding two feet square; and being covered with the alluvium of the bank, to the depth of four feet or upwards, without any vestige of opening or disturbance, the cavern has had no communication with the external air since the alluvial beds were deposited. It has, however, small outlets, running under the alluvium, by which the water that drops from the roof makes its escape; but whether they convey the water to the adjoining stream, or to a subterraneous channel connected with it, cannot be ascertained.

Among the relics entombed in this cavern, no entire skeletons were found; but the bones and teeth of the various animals were scattered about in wild confusion; and most of the bones, particularly those of the larger animals, were broken and mutilated. A great number of the bones had no appearance of being water-worn; but many others were decidedly rounded and smoothed at their projecting parts, bearing obvious marks of having been long agitated by water. A few of the bones were not found in the mud on the floor of the cavern, but in the stalactite on the sides and towards the roof; where they may have been originally lodged on shelves of the rock, and fixed in their places by the progress of the calcareous incrustation formed over them.

The remains of the elephant and of the hippopotamus have been found only in small quantity. No entire elephant's grinder is known to have occurred; but I have seen several fragments of grinders, some belonging to large elephants, and some to small. Not more than two or three specimens of the teeth of the hippopotamus have come under my observation. The remains of the rhinoceros were more plentiful. Some of the larger grinders of that animal, taken from the cave, measure eight or nine inches in circumference at the masticating surface. A specimen of the horn of a rhinoceros is said to have been found; but I have not seen it. Of the ruminating animals, the remains of the elk, or stag, are most copious; numbers of the teeth, with some pieces of the jaw-bones, and fragments of the horns, having been discovered; besides shank-bones, leg-bones, and other relics of that animal. Of the carnivorous animals, the remains of the wolf, the bear, and the tiger, may be noticed as of rare occurrence. Those of the fox were more common. The minute bones belonging to animals of the rat kind, have been found in the mud in con-

siderable quantity; and these are generally more entire than the bones of the larger animals. Several jaw-bones, with the teeth, have been obtained; but I have seen no entire *cranium*, even of these small animals.

Of all the relics in the cavern, however, those of the hyena are the most abundant, the teeth and bones being found in great quantities. Not a few entire jaw-bones, chiefly of the lower jaw, have been obtained; and these are very distinctly characterised, as I have observed, on comparing them with a recent skull of the hyena, in the possession of Mr ATKINSON of York.

Among the mud of the cavern, Professor BUCKLAND discovered some rounded pieces, or balls, of a whitish substance, which he supposes to be the fæcal matter of the hyenas. This substance, being analyzed by Dr WOLLASTON, was found to consist of the same ingredients as the dung of dogs that are fed on bones. I have seen some specimens of this substance; but having observed some pieces of bones nearly in the same state, I am not without suspicion, that the whole may be portions of bone, decomposed in the cavern, and reduced to their present form by a mixture of water and other ingredients. No sand or gravel, or next to none, has been found in the mud; yet I have procured from it two or three small pebbles.

Kirkdale Cavern is not the only cavity in the oolite rocks of that quarter, in which such organic remains have been discovered. In the year 1786, some workmen, employed at a quarry about a mile north-east of Kirkby Moorside, laid open a chasm in the rock, several yards below the surface of the ground, containing a large collection of bones. They were supposed to be the bones of men and horses, whose carcases had been thrown into the chasm, after some battle fought in the neighbourhood: but as the chasm was completely closed above, not by mere alluvial matter, but by

the rock itself, forming a kind of arch over it, that explanation of the phenomenon cannot be admitted. It is much to be regretted, that no scientific inquirer examined the contents of that cavern at the time of the discovery. Mr W. BEARCROFT, an intelligent gentleman, now living at Aislaby, near Pickering, visited the spot some time after, when the most interesting bones had been destroyed or lost. He saw no bones of horses, but perceived a mutilated under-jaw of a hog, and part of a leg-bone of a sheep. Most of the other bones *appeared* to him to be human; and he was told that, at the opening of the cave, there were found nine human skulls, and eighteen *scapulæ*. For want of that minute inquiry which such a subject requires, the real nature of that collection of relics must remain in uncertainty; but I am strongly inclined to consider it as coeval with the Kirkdale collection.

In the Manor Vale, adjoining to Kirkby Moorside, caverns in the limestone have been observed for many years. Mr BIRD and I, at one of our latest visits to that quarter, thought it of importance to have some remaining branches of such caverns examined. Mr BIRD, accordingly, made a search into one or two of the branches. He found no animal remains; but discovered in the bottom a kind of mud, like that in the Kirkdale cavern, with a slight mixture of sand. In this were found a number of pebbles, or small rounded stones, chiefly siliceous; and several pieces of blackish vegetable matter, in so decayed a state, that they had no distinct shape. The spot has been since more fully explored, under the direction of the proprietor, CHARLES DUNCOMBE, Esq. M. P., in the hope of obtaining animal remains; but without success.

Another phenomenon, as mysterious as that exhibited at Kirkdale, was also brought to light in the summer of 1821. Some workmen employed at Pallion Quarry, near Sunder-

land, found there, in the seams between the strata of the magnesian limestone, two teeth, and several fragments of ribs and other bones. One of the teeth appears to have been broken or lost; the other (of which an exact model is presented to the Society) was given me by Mr Thomas Baker, the conductor of the quarry. On my way to Edinburgh, last week, I visited the spot, along with Mr Baker, and the foreman of the quarry, by whom the teeth and bones were found. The place, as stated in the Geological Survey, p. 322, is about sixty-five feet below the surface of the ground, from ten to twenty feet, or more, below the surface of the solid rock, and above an hundred yards from the original face of the quarry, which is towards the bank of the river Wear, fronting the north. The strata have a gentle dip to the south, becoming lower as they recede from the river. There is no vestige of any cave, at the spot where the animal remains were found; nor of any perpendicular fissure, by which they could have fallen down from the surface; nor of any open lateral channel, by which they could be washed into the position which they occupied: but they were found imbedded in a kind of mud, which fills up the seams or horizontal interstices between the beds of limestone. The mud, which is somewhat sandy, rarely exceeds two or three inches thick; but it is of very irregular thickness, as it accommodates itself to the surface of the limestone beds; and these, instead of being smooth, are generally marked with numerous hollows or dimples, which the mud fills up. The bones were not found in any one seam, but in a variety of seams, at various depths, some being ten or twelve feet lower than others; nor was there any visible communication between the higher seams and the lower. Being anxious to ascertain whether any more bones could be found, I directed some of the seams to be examined in my presence; and, after a considerable search,

I had the satisfaction of obtaining one or two small fragments of bone. I also procured from the workmen some pieces of ribs which they had formerly taken out. These relics are now shewn to the Society. I have also added a specimen of the mud, with a portion of the mud from the Kirkdale cavern.

Having stated the leading facts relating to these interesting phænomena, it now remains that some conjectures should be offered for explaining them. This I propose to attempt in a future paper.

XXIII.—*List of Birds observed in the Zetland Islands.*

By Laurence Edmondston, Esq.
Corresponding Member of the Wern. Nat. Hist. Soc.

(*Read 16th November 1822.*)

The utility of zoological topography, in enlarging our acquaintance with the habits and distinctions of animals, and in displaying the nature and extent of those external circumstances, which often so powerfully change and modify them, has been too long acknowledged to be now insisted on. Without its aid, anomalies, in the manners and appearances of different species, will often baffle the sagacity of the naturalist, and, perhaps in his uncertainty and dilemma, tempt him precipitately to take refuge in the most fallacious conclusions. Hence one fertile source of the obscurity which so long enveloped some of the most interesting and elevated provinces of zoology,—the erroneous multiplication of new species, on the one hand,—and their equally unfounded abridgment, on the other.

But it is not alone by facilitating our knowledge of exceptions to general and received facts in this very interesting science, and guarding us against the allurements of premature generalization, that the steady pursuit of this branch of zoology paves the way to its advancement: certain countries, from the peculiarity of their circumstances and geographical situation, furnish opportunities for ascertaining what may be regarded as the pure and general characteristics and habits of the species that frequent them; experience in such favourable situations is then of directly general application, and hence the communication of its results becomes proportionably more interesting. The Zetland Islands, in relation to most of their zoological objects, are precisely in this state; and from the peculiar facilities which they afford to the researches of the naturalist, combine in themselves one of the most select stations for generally applicable and accurate observation and experiment, in this department of natural history. For the study of ornithology they are singularly adapted, and especially for that branch of it that refers to sea-fowl, which in many other countries are usually so difficult of access. In these, Zetland is peculiarly rich for variety and number: and though its land-birds are comparatively few, chiefly perhaps from the absence of woodlands, yet, as far as they extend, they are of equal interest.

The birds more commonly found in these islands have been long since described by authors as inhabiting them. The following list is, therefore, supplementary to theirs, containing fifty-nine additional species that I have met with in this country, few of which are, I believe, generally known to occur in it. They are either permanent inhabitants, annually migratory, or occasional visitants.

PERMANENT INHABITANTS.

Genus FALCO	Ossifragus,	Sea Eagle.
	Palumbarius,	Goshawk.
	Peregrinus,	Peregrine Falcon.
	Tinnunculus,	Kestril.
	Subbuteo,	Hobby.
STRIX	Nyctea,	Snowy Owl.
	(Described in p. 157---160 of this Vol.)	
EMBERIZA	Miliaria,	Bunting.
SCOLOPAX	Pusilla,	The Dunlin.
TRINGA	Hypoleucos,	Common Sandpiper.
COLYMBUS	Minor,	Lesser Guillemot.
	(This I have the most satisfactory reasons for believing to be the young of the Colymbus *troile.*)	
	Stellatus,	Speckled Diver.
	(Conceived to be the young of the Red-throated Diver.)	
	Glacialis,	Great Northern Diver.
	Immer,	Ember Goose.
	(This is only the young of the former.)	
PELICANUS	Cristatus,	Crested Shag.
	(Merely the Common Shag in its perfect dress.)	
ANAS	Marila,	Scaup Duck.
	Glaucion,	Morillon.
	(The young of the Golden Eye.)	
	Crecca,	The Teal.
ALCA	Pica,	Black-billed Auk.
	(This I have ascertained to be the young of the Razor Bill.)	

ANNUALLY MIGRATORY.

Genus FALCO	Buteo,	The Buzzard.
	Æruginosus,	Moor Buzzard.
STRIX	Stridula,	Screech Owl.
EMBERIZA	Mustelina,	Tawny Bunting.
	(This I have no doubt is the Snow Flake in imperfect plumage.)	
FRINGILLA	Carduelis,	Goldfinch.
MOTACILLA	Alba,	White Wagtail.
	Trochilus,	Yellow Wren.
HIRUNDO	Urbica,	The Martin.
SCOLOPAX	Glottis,	Greenshank.
	Ægocephalus,	Godwit.
TRINGA	Canutus,	Knot.
	Squatarola,	Grey Sandpiper.
	Islandica,	Red Sandpiper.
COLYMBUS	Minor,	Little Grebe.
LARUS	Tridactilus,	Tarrock.
	(Ascertained to be the young of the Kittiwake.)	
	Islandicus,	Iceland Gull.
	(Described in p. 176—185, of this Volume.)	
	Crepidatus,	Black-toed Gull.
	(The young of the Arctic Gull.)	
ANAS	Spectabilis,	King Duck.
	Nigra,	Scoter.
	Bernicla,	Brent Goose.
	Penelope,	Wigeon.
	Acuta,	Pintail Duck.
MERGUS	Merganser,	Goosander.

OCCASIONAL VISITANTS.

Genus Falco	Crysaëtos,	Golden Eagle.
	Milvus,	Kite.
	Islandicus,	Iceland Falcon.
	Cyaneus,	Hen Harrier.
Strix	Passerina,	Little Owl.
Upupa	Epops,	Hoopoe.
Cuculus	Canorus,	Cuckoo.
Turdus	Musicus,	Mavis.
Ampelis	Garrulus,	Bohemian Chatterer.
Loxia	Curvirostra,	Cross Bill.
Glareola	Pratincola,	Austrian Pratincole.
Hirundo	Apus,	Swift.
Platalea	Leucorodia,	Spoonbill.
Ardea	Stellaris,	Bittern.
Tringa	Pusilla,	Little Sandpiper.
Charadrius	Hæmantopus,	Long-legged Plover.
Recurvirostra	Avocetta,	Avoset.
Fulica	Atra,	Common Coot.

Zetland,
July 10. 1822.

XXIV.—*An Illustration of the Natural Family of Plants called Melastomaceæ.*

By Mr David Don, Curator of the Lambertian Herbarium, and Corresponding Member of the Wernerian Natural History Society.

(*Read* 16*th November* 1822.)

THE Melastomaceæ may, with propriety, be ranked among the most natural, and least understood, orders in the vegetable kingdom. What renders the study of this family extremely difficult, is, that the greater part of the plants which compose it are natives of tropical countries, and, except the few that we see in cultivation, we have no opportunity of examining them in a living state. And previous to an examination of dried specimens, it is necessary to have an extensive assortment of different species for comparison, and these in different states, which is not easily obtained. In this respect, however, I consider myself as having been very fortunate, having had fine specimens, in various stages, of several hundred species, for examination,

Mr LAMBERT has paid particular attention to this order, and his herbarium now contains undoubtedly the finest collection of Melastomaceæ in Europe. Another, and certainly the greatest difficulty, attending the study of this order, is the want of striking, discriminating characters. This circumstance has no doubt occasioned the union of a vast number of species to *Melastoma* and *Rhexia*, which are generically distinct from the plants on which LINNÆUS founded these two genera, in the first edition of his *Genera Plantarum*. His short imperfect characters, which chiefly depended on number, might equally apply to all the plants of this family. An attentive examination, however, of these plants shews that we need not despair of finding sufficient differential marks. The more free communication with the Islands and Continent of the New World, and the researches of various naturalists in these regions, had increased the number of species to such an extent, that many botanists really felt the necessity of dividing them into various genera. Among the successful labourers in this department, we may mention in an especial manner AUBLET, JUSSIEU, RUIZ and PAVON. Although GÆRTNER does not appear to have given any particular attention to this subject, yet nevertheless to him we are indebted for having been the first to bring into the descriptions, the important aid of characters deduced from the structure of the seeds and form of the embryo. The labours of these naturalists, however, do not seem to have been rightly estimated, nor to have had any important influence on the subsequent labours of other botanists. M. BONPLAND, who, of all others, might have been considered as the most likely to have been able to give importance to the divisions proposed by AUBLET, JUSSIEU, RUIZ and PAVON, and to the characters illustrated by GÆRTNER, has adhered to the old division; and it is a remarkable fact, that, in his recent

extensive monographs of *Melastoma* and *Rhexia*, there does not exist almost a single species (as has been justly observed by Mr BROWN) which really belongs to these two genera. The whole of *Melastomaceæ* agree in some important points of structure, the most remarkable of which, first observed by Mr BROWN *, is the singular position of the stamens in æstivation; the filaments are inserted in the margin surrounding the mouth of the calyx; the anthers hang down in a direct position, in the space between the calyx and ovarium. Almost immediately on the expansion of the flowers, the stamens ascend upwards, and hence they frequently become declinate, or curved. On the increase of the ovarium, the space between it and the calyx is gradually filled up; and, in some cases, the capsule becomes closely united to the tube of the calyx, as in *Miconia*, *Conostegia*, *Tococa*, &c. The anthers of all open with terminal pores; and in the greater part of the genera, each anther opens with only a solitary pore, but in *Blakea*, and a few others. with two: they are all likewise appendiculated at the base. The stigma is constantly simple. The capsule varies, with from four to six cells, rarely eight, and very rarely but three. each cell opens in the middle with an oblong fissure, by which the seeds are shed, and the dissepiments are inserted into the centre of each valve. The receptacles correspond with the number of cells, except in *Conostegia*, where they are contiguous with the alternate dissepiments, which are consequently eight in number. They are sometimes lunate, and attached by a short flat pedicel, to the central axis or columella, as in *Rhexia*; but in most genera, they are oblong three-sided, and attached longitudinally to the central axis. Where they are thick and fleshy the capsule assumes

* Observations on the Botany of the Congo, p. 435.

the appearance of a berry, as in *Melastoma*, *Miconia*, &c., and the seeds appear as if imbedded in a pulp. The seeds are destitute of albumen; they are reniform in *Melastoma*, *Rhexia*, &c., but mostly ovate, or oblong-cylindrical. The shell or covering in most cases is double. The embryo corresponds with the figure of the seeds; in those with reniform seeds it is arcuate, and in those with ovate or oblong seeds it is straight. The greater part of the plants of this family have berried capsules, which are very juicy, and of an agreeable sweet taste; some, such as those of *Blakea quinquenervis*, grow to a great size, and equal that of a pomegranate. In Guiana, Brazil, and other countries, where the *Melastomaceæ* abound, the berries are eagerly sought after, and eaten by the children of the native tribes. The Melastomaceæ abound in all tropical countries; but especially in the Islands and Continent of the New World. The genera *Miconia*, *Axinæa*, *Blakea*, *Chitonia*, *Tococa*, *Meriania*, *Pleroma*, *Rhexia*, *Microlicia*, *Clidemia*, *Cremanium*, &c. appear to be exclusively confined to it. On the contrary, *Melastoma* and *Osbeckia* are common to both Continents: to the former genus, I have referred the *Tibouchina*, Aub. t. 177., and *Tristemma*, Juss. *Rhexia* is the only extratropical genus in the whole order, being solely confined to North America: its species are also all dwarfish herbaceous perennials, or annuals. The only other genus, in which herbaceous plants are found, is *Osbeckia*, which consists of shrubs and annuals. The other genera all consist of either trees or shrubs. The whole order agrees, however, in having opposite, undivided, mostly petiolated, leaves, with three, five, or rarely seven, nerves running through them. The flowers are mostly terminal, panicled, racemose, or corymbose, rarely capitate: in *Blakea* and *Meriania*, they are axillary and solitary, on long peduncles. Number, in the parts of the flower or

fructification, is very variable, and, therefore, as a character, is of little importance in this order; but the regularity and constancy in the increase of the number of these parts is truly admirable, and affords a fine and satisfactory illustration of the correctness of Mr Brown's beautiful theory, regarding the increase in number of the parts of fructification, and the proportions which they bear to each other. In some genera, for instance, *Pleroma* and *Melastoma*, where we sometimes find the calyx of six divisions, the petals are constantly six, and the capsule has always six cells. The stamens regularly double that number; and, therefore, for every additional part, two stamens are always added. Aublet, in describing his *Blakea quinquenervis*, has evidently mistaken the exterior scales for the calyx, and confounded the true calyx with the capsule. The same botanist states, but very incorrectly, that the anthers of *Melastoma* burst lengthwise into two cells. Although the *Topobæa* of Aublet recedes somewhat from *Blakea*, in its being parasitical; yet, notwithstanding, in the Lambertian Herbarium are several unpublished species, from Don Jose Pavon, natives of Peru, and not parasitical, which agree with *Topobæa* in every essential point; and these, also, accord well with *Blakea*, except in having four, instead of six scales, surrounding the calyx, which, however, is a variable character; and, therefore, I think myself justified in uniting these two genera. Some may, probably, think the differential characters I have given too diffuse; but, in an order like this, where so intimate an affinity exists among the individuals which compose it, we are obliged, for the sake of perspicuity, to introduce, perhaps, characters of minor importance.

Nat. Ord. Melastomaceæ, *Juss.*

Calyx monophyllus, tubulosus, basi nudus aut squamis cinctus.

Petala 4-6, lata, in ore calycis margini annulari inserta, in æstivatione involuta, laciniis aut denticulis calycinis alterna.

Stamina eidem margini inserta, declinata, definita, petalorum dupla: *antheræ* longæ, lineares, carinatæ, biloculares, sæpiùs incumbentes, rostratæ, semper apice poro aut foramine unico (in *paucis* gemino) hiantes, nunc basi nunc posticè filamentis affixæ, ad basin biauriculatæ vel processu calcarato instructæ, æstivantes in vacuo inter calycem et ovarium directò dependentes, ad explicationem assurgentes.

Pistillum unicum: *ovarium* calyce tectum, liberum aut ibidem connatum: *stylus* teres, sæpiùs incurvus: *stigma* simplex, integrum.

Capsula calyce obvoluta, libera aut cum eo connata, in *aliis* baccata in *aliis* sicca, 3-6-locularis, (in *Conostegiâ* 8-locularis): *loculis* polyspermis, medio rimâ oblongâ dehiscentibus, nisi in *Conostegiâ* numero petalorum æqualibus.

Placentæ 3-6, axi centrali adnatæ, scrobiculatæ imbricatè seminiferæ, in *baccatis* carnosæ et pulposæ.

Semina ∞, minuta, reniformia vel ovata aut oblonga: *testa* crustacea, fragilis, in *plerisque* duplex; interiore membranaceâ: *albumen* nullum.

Embryo semini conformis modò arcuatus, modò rectus: *cotyl.* breves, crassæ, obtusæ, applicatæ, sæpe inæquales: *radicula* cylindracea, cotyledonibus longior.

Arbores *aut* frutices *vel rariùs* herbæ. Folia *opposita, indivisa, 3, 5 vel 7-nervia, impunctata, sæpiùs integerrima, petiolata.* Flores *terminales, corymbosi, paniculati, racemosi, aut rariùs subsolitarii, vel axillares solitarii aut aggregati.*

Obs. Melastomaceæ, ut rectè habet illustris Jussieu, medium quasi inter Myrtaceas et Salicarias tenent: ab Salicariis discrepant, antheris rostratis basi appendiculatis poris apice hiantibus. In *Myrtaceis veris* antheræ breves, incumbentes, medio filamentis adnatæ utrinque nudæ, duplici rimâ longitudinali dehiscentes, folia enervia, pellucido-punctata; sed in *Petaloma*, Swartz, antheræ longæ, basi filamentis adnatæ, duplici rimâ breviore dehiscentes et folia impunctata. Atque in *Memecylon*, Du Petit Thouars, antheræ oblongæ, incumbentes, ferè per medium filamentis adnatæ, duplici rimâ longitudinali dehiscentes et folia nunc uninervia, in *aliis* obsoletè trinervia.

SYNOPSIS GENERUM, CUM CHARACTERIBUS DIFFERENTIALIBUS.

§ 1. *Semina* simplici gyro cochleata, apice umbilico magno cancavo notata. *Embryo* arcuatus, semini conformis. *Cotyledones* inæquales; superiore duplò crassiore. ***Frutices aut Herbæ.***

1. Melastoma. *Calyx* limbo 5 raró 6-fidus: *laciniis* deciduis, sæpè minimâ interjectis: *petala* 5 raró 6: *antheræ* basi processu bicalcarato v. bisetoso instructæ; alternis majoribus, pedicello longo filiformi suffultis: *stigma* punctum, pruinosum: *capsula* baccata, 5 raró 6-locularis.

2. OSBECKIA. *Calyx* limbo 4 rarò 5-fidus: *laciniis* persistentibus v. deciduis, sæpè squamulâ interjectis: *petala* 4 rarò 5: *antheræ* æquales, basi biauriculatæ, apice in rostrum tenue desinentes: *stigma* punctum pruinosum: *capsula* sicca, 4 rarò 5-locularis.

3. PLEROMA. *Calyx* limbo 5-partitus: *laciniis* caducis: *petala* 5: *antheræ* subæquales, basi arcuatæ, in stipite brevissimo productæ, biauriculatæ: *stigma* punctum pruinosum: *capsula* baccata, 5-locularis.

4. DIPLOSTEGIUM. *Calyx* limbo 5-fidus, persistens, in calyptrâ duplici cucullatâ hispidâ inclusus! *petala* 5: *antheræ* subæquales, basi biauriculatæ: *stigma* punctum pruinosum: *capsula* baccata, 5-locularis.

5. RHEXIA. *Calyx* basi ventricosus, apice in collo angustatus: *limbo* 4-fido, persistente: *petala* 4: *antheræ* incumbentes, posticè filamentis affixæ, basi nudæ: *capsula* in ventro calycis libera, 4-locularis: *placentæ* lunatæ, pedicellatæ.

6. ARTHROSTEMA. *Calyx* oblongus, æqualis, limbo 4-fidus, persistens: *petala* 4: *antheræ* incumbentes, basi calcare longissimo clavato adscendente instructæ: *capsula* sicca, 4-locularis, tubo calycino æqualis.

7. ACIOTIS. *Calyx* globosus, carnosus, limbo coarctatus, persistens, 4-dentatus: *petala* 4, apice obliquè aristata: *filamenta* medio articulata. *antheræ* erectæ, basi nudæ: *capsula* baccata, 4-locularis.

8. MICROLICIA. *Calyx* globosus, limbo 5-partitus, persistens: *petala* 5: *antheræ* stipite longissimo filamenta incumbente et cujus extremitate processu simplici calcarato instructa suffultæ: *capsula* sicca, 3-locularis, 3-valvis!

§ 2. *Semina* ovoidea v. oblonga, umbilico laterali, sæpiùs crasso, convexo, aucta. *Embryo* rectus, semini conformis. *Cotyledones* subæquales. *Arbores aut Frutices.*

9. Tococa. *Calyx* oblongus, basi nudus v. squamosus; *limbo* urceolato, persistente, 5-dentato: *petala* 5: *antheræ* æquales, basi posticè biauriculatæ: *stigma* magnum, orbiculato-peltatum: *capsula* baccata, 5-locularis.

10. Clidemia. *Calyx* oblongus, basi nudus v. squamosus, limbo persistens, 5-dentatus: *petala* 5: *antheræ* basi constrictæ, biauriculatæ: *stigma* punctum pruinosum: *capsula* baccata, 5-locularis.

11. Cremanium. *Calyx* campanulatus; *limbo* urceolato persistente 4 rariùs 5-dentato: *petala* 4 v. 5: *antheræ* breves, subcuneatæ, apice duplici foramine hiantes! *stigma* orbiculato-peltatum: *capsula* baccata, 4 v. 5-locularis.

12. Centronia. *Calyx* oblongus, undique setis retrorsis vestitus; *limbo* coarctato, integro! *petala* 5: *antheræ* longissimæ, rostratæ, basi processu longo subulato acutissimo instructæ: *stylus* in collo tubuloso elongato ovarii inclusus! *stigma* obtusum: *capsula* 5-locularis.

13. Miconia. *Calyx* limbo, persistens, 5-dentatus: *dentibus* brevissimis, apice intùs membranâ latâ obtusâ auctis: *petala* 5: *antheræ* basi auriculatæ: *capsula* baccata, 5-locularis.

14. Conostegia. *Calyx* limbo indiviso, conico, calyptrato, in æstivatione e tubo circumscisso et decidente: *pe-*

tala 5-6: *antheræ* basi biauriculatæ: *capsula* baccata, 8-locularis.

15. Chitonia. *Calyx* tubulosus, basi squamis duabus bracteatus, limbo persistens, 5-dentatus: *petala* 5: *antheræ* apice rostratæ: *stigma* peltatum: *capsula* baccata, 5-locularis.

16. Axinæa. *Calyx* cyathiformis, basi nudus, limbo persistens, 5-6-denticulatus: *petala* 5-6: *antheræ* apice obtusæ, duplici poro dehiscentes! basi in processu simplici calcarato productæ: *capsula* libera, 5-6-locularis.

17. Meriánia. *Calyx* campanulatus, basi nudus, limbo persistens, 5-6-dentatus: *dentibus* lineari-subulatis, intùs membranâ latâ auctis: *petala* 5-6: *antheræ* apice obtusæ, duplici poro hiantes! basi processu brevissimo calcarato instructæ: *capsula* libera, 5-6-locularis.

18. Blakea. *Calyx* campanulatus, basi squamis latis 4 v. 6, cruciatim vel triplici ordine dispositis cinctus; *limbo* persistente, membranaceo, 6-lobo v. 6-denticulato: *petala* 6: *antheræ* magnæ, in annulum concatenatæ, apice obtusæ, poro gemino hiantes! basi processu brevi calcarato instructæ: *capsula* baccata, calyce connata, 6-locularis.

MELASTOMA, *Burm.*, *Linn.*

MELASTOMÆ et RHEXIÆ sp. *Auctorum.*
TIBOUCHINA, *Aubl.*, *Juss.*
TRISTEMMA, *Juss.*

Calyx campanulatus aut oblongus, tubulosus, extùs setosus v. squamulosus, raró nudus, dum juvenis squamis duabus membranaceis ad basin munitus, limbo 5-fidus, quandòque 6-fidus: *laciniis* deciduis, sæpè minimâ interjectis. *Petala* 5 rariùs 6, lata, obovata v. lateribus inæqualibus subdolabriformia, obliquè mucronulata, basi ungue lato brevissimo in summo tubo calycis ad marginem circularem affixa. *Stamina* 10 v. 12, inæqualia, eidem margini inserta: *filamenta* erecta, linearia, compressa, glabra: *antheræ* longissimæ, subtrigonæ, biloculares, dorso carinatæ, anticè canaliculatæ et rugoso-plicatæ, apice poro obliquo solitario hiantes; alternæ multò majores, declinatæ, pedicello (antherarum carinæ continuatione) longo filiformi cujus extremitate processu bicalcarato nunc bisetosa instructâ filamenta propria incumbente suffultæ; cæteris erectis basi similiter bicalcaratis sed absque pedicellis. *Ovarium* subrotundum v. ovatum, tubo calycino inclusum et ejus basi arctè connatum, apice pilis coronatum. *Stylus* teres, declinatus, robustus, stamina breviora subæquans, glaber, supernè curvatus et angustior. *Stigma* apex isoperimetrus, obtusus, pruinosus. *Capsula* baccata tubo calycino obvoluta, 5-locularis, 5-valvis, quandòque 6-locularis 6-valvis, à rimâ oblongâ medio cujusque loculi 5 raró 6-fariam dehiscens. *Dissepimenta* 5-6, membranacea medio valvarum inserta, axi centrali leviùs connexa. *Placentæ*

5 v. 6, magnæ, oblongæ, trigonæ, carnosæ, scrobiculatæ, imbricatè seminiferæ, angulis columellæ adnatæ. *Semina* numerosa, reniformi-subrotunda, punctata, badia v. fusca: *testa* duplex; exterior crustacea, fragilis; interior membranacea. *Embryo* arcuatus, semini conformis, lacteus: *cotyl.* inæquales, crassæ, breves, convexæ, applicatæ; superiore duplò crassiore: *radicula* teres, attenuata, cotyledonibus multò longior, curvata, vaga.

Frutices (*Asiæ Orient. Afric. et Amer. Æquin.*) *humiles sæpius hispidè setosi.* Folia *petiolata, integerrima* (*in* duabus *serrata*), *3-7-nervia.* Flores *pedunculati, terni v. plures terminales sivè rarò axillares, ampli, rosei aut purpurei.*

Obs. Melastoma, ut nunc limitata, genus verè naturale et abundè discrepans ab proxima *Osbeckiâ*, antherarum structurâ singulari et capsulâ baccatâ, constituere videtur. Tristemma, Juss. cui, ni fallor, nullus character nisi falsus est hùc revocanda; ob certè triplicem annulum ciliari-squamulosum calycis non semper stabile signum esse, et nequaquam pro discrimine generico habenda sit. In exemplo sicco hujus plantæ ex Insulâ France squamulas calycis quandòque sparsas, ut in pluribus aliis speciebus, observavi; et in proximâ specie ex Sierra-Leonâ calyces ferè nudi sunt. Characteres omnium specierum quas determinavi, hìc infrà adjiciuntur.

1. *Melastoma Malabathrica*, ramis squamulosis, foliis elliptico-oblongis acutis quinquenerviis utrinque viridibus asperis, floribus subternis, calycibus densè squamulosis.

Melastoma Malabathrica, *Linn.*

Hab. in Insulâ Ceylonâ. ♄. (v. v. c. et s. spont. in Herb. Lamb.)

2. *M. affinis*, ramis squamulosis, foliis lanceolatis acutis trinerviis utrinque pilosis asperis, floribus subternis, calycibus densè squamulosis.

Hab. ad Freta Sundæ dicta (*Georgius Staunton, baronettus*) in Indiâ Orientali. *Roxburgh.* ♄. (v. s. in Herb. Lamb.)

Obs. Præcedenti nimìs affinis et forsan varietas ejus; sed quidem differt: foliis longioribus angustioribusque trinervibus magìs asperis.

3. *M. candida*, ramis squamulosis, foliis ovalibus acutis 7-nerviis utrinque densè sericeis candidis, calycibus mollibus squamulis lineari-elongatis appressis niveis obtectis.

Hab. in Chinâ, etiamque ad Freta Sundæ dicta. *Georgius Staunton, baronettus.* ♄. (v. s. in Herb. Lamb.)

4. *M. aspera*, foliis ellipticis acutis 3-nerviis utrinque viridibus ramulisque setoso-pilosis asperis, floribus paniculatis, calycibus hispidis: laciniis oblongis obtusis carinatis.

Melastoma aspera, *Linn.*

Hab. in Insulâ Ceylonâ. ♄. (v. s. in Herb. Lamb.)

5. *M. Tibouchina*, foliis ovatis, acutis 5-nerviis reticulatis subtùs ramisque squamulosis scabris, floribus paniculatis, calycibus oblongis extùs squamulis lineari-lanceolatis aristatis scariosis densè tectis basi duplici squamâ monophyllâ vaginatis.

Melastoma Tibouchina, *Lam. Encycl.* 4. p. 49.

Rhexia aspera, *Willd. Sp. Pl.* 2. p. 304.

Tibouchina aspera, *Aubl. Guj.* 1. p. 446. t. 177.

Hab. in Guianâ. *Aublet, Martin.* ♄. (v. s. in Herb. Lamb.)

Frutex erectus, paniculatìm ramosissimus. *Calyces*

oblongi, cylindrici, tubulosi, extùs squamulis glumaceis densè tecti, basi squamis duabus monophyllis tubulosis supernè fissis vaginati, limbo 5-partiti: *laciniis* ovato-lanceolatis aristatis scariosis extùs ut cum ramulis bracteisque lepidotis. *Flores* magni, purpurei. *Antheræ* basi processu bicalcaratæ instructæ, pedicellis brevioribus suffultæ.

6. *M. macrocarpa*, foliis ovato-lanceolatis acuminatis 5-nerviis utrinque petiolisque viridibus asperis suprà opacis, calycibus setis longissimis patente-incurvis tectis, ramis hispidis.

M. Malabathrica, *Bot. Mag.* t. 529. (exclus. Synon.)

Hab. in Chinâ. ♄. (v. v. c.)

Frutex tripedalis, frondosus, ramosus, erectus. *Folia* ovato-lanceolata, acuminata, 5-6-pollicaria, latitudine ferè biuncialia. *Flores* rosei, diametro 2-3-unciales, plerumque decandri. *Calyces* terminales, solitarii v. terni, pedunculo brevi tereti crassitudine *pennæ corvi* suffulti, omninò tecti setis longissimis viridibus incurvis intricatisque supernè diaphanis: *laciniis* deciduis, ovato-lanceolatis, acuminatis, intùs glabris, extùs piloso-setosis, minimâ lineari interjectis.

7. *M. sanguinea*, foliis ovato-lanceolatis acuminatis 5-nerviis suprà viridibus nitidis subtùs ad nervos ut cum petiolis rubro-purpureis, calycibus setis longissimis incurvo-patentibus tectis, ramis sanguineo-hispidissimis.

Melastoma sanguinea, *Bot. Mag.* t. 2241.

Hab. ad Freta Sundæ dicta (*Georgius Staunton, baronettus*) in Chinâ (B. M.) ♄. (v. v. c. et s. spont. in Herb. Lamb.)

Obs. Præcedenti simillima, sed differt: setis magis confertis sanguineis, foliis longioribus suprà nitidis subtùs ad nervos purpureo-rubris.

8. *M. grandiflora*, foliis cordatis acuminatis 5-nerviis utrinque viridibus ramisque setosis, calycibus pilis patentibus setosis tectis: laciniis lineari-lanceolatis acutis.

Melastoma grandiflora. *Aubl. Guj.* p. 414. t. 160. *Vahl, Symb.* 3. p. 59. *Willd. Sp. Pl.* 2. p. 589

Hab. in pratis Guianæ, *Aublet.* ♄.

Frutex 3-pedalis. *Flores* violacei, terminales v. axillares, terni.

9. *M. Madagascariensis*, foliis ellipticis 3-nerviis mucronatis basi acutis subtùs ramisque hispidè pilosis, floribus paniculatis, calycibus hispidis, antheris basi processu longissimo bisetoso instructis.

Hab. in Insulâ Madagascar. *Thomson.* ♄. (v. s. in Herb. Lamb.)

10. *M. Mexicana*, foliis lanceolatis acuminatis 3-nerviis utrinque cauleque pilosis, floribus solitariis aut geminis terminalibus axillaribusve, calycibus pilosis: laciniis linearibus acutis.

Melastoma aspera. *Pavon MSS.*

Hab. in Imperio Mexicano. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex erectus, spithameus, ramosus. *Flores* rosei.

11. *M. involucrata*, foliis latè ellipticis acuminatis 5-nerviis utrinque ramisque hirsutis, floribus terminalibus axillaribusque sessilibus glomeratis bracteis foliaceis involucratis, calycibus pilosis: laciniis lanceolatis acuminatis.

Hab. in Sierra-Leonâ. *Afzelius.* ♄. (v. s. in Herb. Lamb.)

Fruticulus facie omninò sequentis. *Glomeri* 3-4-flori.

12. *M. virusana*, foliis ovalibus acuminatis 5-nerviis utrinque ramisque hispidè pilosis, floribus termina-

libus sessilibus glomeratis bracteis foliaceis involucratis, calycibus triplici annulo setoso auctis: laciniis lanceolatis acutis.

Melastoma virusana, *Commerson.*

Tristemma virusana, *Juss. Gen.* p. 329.

Hab. in Insulâ Mauritianâ (*Commerson*), *Hardwicke.* ♄? (v. s. in Herb. Lamb.)

13. *M. plumosa*, foliis subrotundo-ovatis 3-nerviis utrinque cauleque hirsutis, floribus sparsis solitariis, calycibus squamulis plumosis stellatis obtectis, caule procumbente.

Hab. in Sierra-Leonâ. *Afzelius.* ♄. (v. s. in Herb. Lamb.)

Fruticulus procumbens.

14. *M. Afzeliana*, foliis ovatis acuminatis 5-nerviis utrinque ramisque hispido-pilosis, floribus terminalibus subpaniculatis, calycibus setis hispidis plerumque fasciculatis tectis: laciniis linearibus apice plumosis.

Hab. in Sierra-Leonâ. *Afzelius.* ♄. (v. s. in Herb. Lamb.)

15. *M. elongata*, foliis lanceolatis acutis 3-nerviis utrinque cauleque villosis, pedunculis axillaribus terminalibusque plurifloris, calycibus oblongis extùs squamuloso-hispidis: laciniis oblongis membranaceis apice setosis.

Osbeckia grandiflora, *Afzelius MSS.*

Hab. in Sierra-Leonâ. *Afzelius.* ♄. (v. s. in Herb. Lamb.)

Rami elongati, tetragoni, erecti, supernè nudiusculi.

16. *M. diffusa*, foliis ovatis acutis 3-nerviis serratis subtùs pilosiusculis, floribus axillaribus solitariis pedicellatis, calycibus globosis subnudis: laciniis lan-

ceolatis mucronatis, caule decumbente ramosissimo piloso.

Melastoma diffusa, *Pavon MSS.*

Hab. ad Portum Rico dictum. *Pavon.*

Fruticulus? caulibus tetragonis. *Flores* purpurei.

17. *M. corymbosa*, foliis cordatis acuminatis 7-nerviis subpilosis margine serrulatis, corymbo terminali multifloro, calycibus nudiusculis: laciniis ovatis acutis.

Melastoma corymbosa, *Hort. Kew.* 3. p. 46.

Hab. in Sierra-Leonâ. *Afzelius.* ♄. (v. v. c.)

18. *M. laniflora*, foliis ovalibus coriaceis integerrimis suprà nudis subtus ramisque densè niveo-lanatis, floribus axillaribus numerosis sessilibus, calycibus niveo-lanatis.

Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)

Frutex erectus, densè niveo-lanatus. *Folia* ovalia, pollicaria, ½-uncialis lata, suprà nuda et nitida. *Flores* albi, axillares, plures, subverticillati. *Calyces* oblongi, limbo 5-partitus: *laciniis* linearibus.

OSBECKIA, *Linn. Juss.*

Calyx campanulatus aut oblongus, tubulosus, extùs setosus v. squamulosus, quandoque nudus, basi in æstivatione squamis 2 aut pluribus membranaceis munitus, limbo 4 sive 5-fidus: *laciniis* deciduis aut persistentibus, sæpè minimâ setosâ interjectis. *Petala* 4 v. 5, late obovata, ungue brevi lato instructa tubo calycis inserta. *Stamina* 8 aut 10, æqualia, eodem margini intra petala inserta: *filamenta* linearia, compressa, glabra, interdum supernè clavata, nunc erecta nunc ad latus superius adscendentia: *antheræ* longæ, declinatæ, subulatæ, biloculares, dorso obtusè carinatæ, anticè rugosæ et canaliculâ (quòd valvas separat) depressâ

exaratæ, apice rostro longo gracili elastico nunc ferè setaceo poro obliquo dehiscente instructæ, basi concavæ, filamentis fermè adfixæ, auriculatæ. *Ovarium* globosum v. ovatum, calyce inclusum, apice setis aut cupulâ hispidâ coronatum. *Stylus* teres, declinatus, glaber, stamina æquans v. iisdem longior, supernè curvatus. *Stigma* apex isoperimetrus, obtusus, pruinosus. *Capsula* sicca, calyce obtecta, 4-locularis, 4-valvis, quandoque 5-locularis, 5-valvis, singulorum loculorum medio à rimâ longitudinali 4 v. 5-fariam dehiscens. *Dissepimenta* tenuia, subcrustacea, medio valvarum inserta, axi centrali affixa. *Placentæ* 4 aut 5, trigonæ, lunatæ, valdè scrobiculatæ, imbricatè seminiferæ, in singulis loculis singulæ, angulis columellæ basi latâ planâ adnatæ. *Semina* reniformi-globosa, parva, numerosa, badia v. cinereo-fusca, punctata aut papilloso-scabra: *testa* duplex; exterior crustacea, fragilis; interior tenuissima, membranacea: *albumen* nullum. *Embryo* semini conformis, arcuatus, lacteus: *cotyl.* inæquales, plano-convexæ, breves, crassæ: *radicula* cylindracea, cotyledonibus longior, curvata, vaga.

Frutices *humiles aut* herbæ (*plerumque Asiæ Orient. Trop.*) *hispidæ v. hirsutæ.* Folia *integerrima, petiolata, 3 v. 5-nervia.* Flores *magni, lilacini v. purpurei aut albi, rarissimè lutei, plerùmque plures terminales glomerati, nunc sessiles nunc brevè pedunculati, raro subsolitarii aut axillares.*

Obs. Hùc referendæ sunt, Osbeckia Chinensis et Zeylanica, *Linn.*, Rhexia glomerata, *Rœttb. Willd.*, præter plures ineditas ex Nepaliâ.

Pleroma.

Melastomæ sp. *Auctor.*

Calyx oblongus, tubulosus, quandoque obtusè pentagonus, extùs sericeo-canescens aut raró hispidus, basi squamis

duabus membranaceis in æstivatione munitus: *limbo* 5 quandòque 6-partito, patente, rotato, ferè simul cum petalis caduco. *Petala* 5 rarò 6, obovata v. obcordata, apice quandòque obliquè mucronulata, ad summam tubi calycini insidentia. *Stamina* 10 rarò 12, declinato-assurgentia, subæqualia: *filamenta* teretia (interdum compressiuscula), glandulis paucis capitatis aspersa aut rariùs pilosa v. barbata: *antheræ* longissimæ, subulatæ, basi suprà papilloso-glandulosæ, biauriculatæ, in stipite brevissimo arcuato productæ, anticè transversè rugosæ, supernè rostratæ poro unico obliquo dehiscentes. *Ovarium* ovatum tubo calycis inclusum, truncatum. *Stylus* teres, elongatus, declinatus, supernè curvatus. *Stigma* punctum pruinosum. *Capsula* baccata, tubo calycino obtecta, 5 rariùs 6-locularis, medio cujusque loculi à rimâ oblongâ quinquefariam dehiscens. *Dissepimenta* membranacea, medio valvarum inserta, axi centrali leviùs connexa. *Placentæ* 5 interdùm 6, oblongæ, trigonæ, carnosæ, in singulis loculis singulæ et iisdem conformes, scrobiculatæ, imbricatè seminiferæ. *Semina* numerosa, reniformi-globosa, punctata, pallidè fusca: *testa* simplex, crassiuscula, crustacea, fragilis: *albumen* nullum. *Embryo* arcuatus, semini conformis, albus: *cotyl.* inæquales, breves, crassæ, subovales: *radicula* teres, vaga, cotyledonibus longior.

Frutices (*Brazilienses* v. *Peruviani*) *spectabiles, sericeo-canescentes aut hispidè setosi.* Folia *integerrima*, 3 *v.* 5-*nervia, petiolata aut rariùs* (*in* holosericeâ) *subsessilia.* Flores *terminales, paniculati, speciosi, purpurei aut violacei.*

Obs. Genus ab *Melastomâ* cui proximum discrepans: limbo calycis ferè simul cum petalis caduco, antheris subæqualibus basi arcuatis absque processu bicalcarato, testâ seminis simplici.

Nomen duxi ab voce Græca πλήρωμα, *plenitudo*, quòd loculi capsulæ placentis carnosis seminiferis farcti sunt. Ad hoc genus pertinent species hìc infrà descrìptæ.

1. *P. heteromalla*, foliis cordato-ovalibus petiolatis subtùs flocculoso-lanatis, laciniis calycinis oblongis obtusis, petalis obcordatis.

   Melastoma heteromalla, *Don in Bot. Reg.* t. 644.

   Hab. in Braziliâ. ♄. (v. v. c.)

2. *P. holosericea*, foliis cordato-ovalibus sessilibus obtusis utrinque cano-sericeis, laciniis calycinis ovato-lanceolatis acutis, petalis latè obovatis.

   Melastoma holosericea, *Swartz Obs.* 176.

   ——— velutina, *Willd. Sp. Pl.* 2. p. 584.

   Hab. in Jamaicâ (*Swartz*), in Braziliâ. *Georgius Staunton, baronettus, Sello.* ♄. (v. v. c. et s. spont. Herb. Lamb.)

3. *P. ochypetala*, foliis lanceolatis, acutis, 5-nerviis, utrinque ramulisque hispidis, calycibus hispidis, petalis obliquè mucronulatis, filamentis pilosis.

   Rhexia ochypetala, *Fl. Peruv.* 3. p. 86. t. 321.

   Hab. in Chinchao prærupto, et in Pillao montibus apertis aliisque regionibus montosis Peruviæ. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)

   Frutex 3-orgyalis. *Flores* magni, purpurei. *Antheræ* basi suprà glandulosæ. *Capsula* baccata, 5-locularis.

4. *P. granulosa*, ramis tetragonis foliaceo-alatis, foliis lanceolatis acutis suprà scabris subtùs velutinis, calycibus cano-sericeis, filamentis barbatis.

   Melastoma granulosa, *Lam. Encycl.* 4. p. 44.

   Rhexia Fontanesii, *Bonpl. Rhex.* t. 36.

   Hab. in Braziliâ. *Commerson, Georgius Staunton, baronettus, Langsdorff.* (v. v. c. et s. spont. in Herb. Lamb.)

5. *P. viminea*, foliis ovato-lanceolatis acutis petiolatis ramisque scabris subtùs canescentibus, calycibus glanduloso-pilosis: laciniis lanceolatis mucronatis.

Hab. in Braziliâ. *Georgius Staunton, baronettus, Sello.* ♄. (v. v. c. et s. spont. in Herb. Lamb.)

Diplostegium.

Calyx oblongus, campanulatus, densè sericeo-pilosus, limbo persistens, 5-fidus, in calyptrâ duplici cucullatâ densè setosâ omninò inclusus, calyptra quæ accreto flore è basi calycis circumrumpens et denique decidens. *Petala* 5, latè orbiculata, sessilia, in ore calycis margini circumambienti affixa. *Stamina* 10, inæqualia, eidem margini inserta: *filamenta* linearia, compresso-plana, hispidè pilosa; alternis brevioribus: *antheræ* longissimæ, subulatæ, carinatæ, basi auriculis duabus glanduliferis munitæ, supernè compressæ, foramine obliquo terminatæ. *Ovarium* ellipticum, apice cum parte inferiore styli densè pilosum, calyce inclusum. *Stylus* teres, robustus, supernè glaber et paulò curvatus. *Stigma* punctum pruinosum. *Capsula* baccata, 5-locularis, 5-valvis, calyce involuta et ejus basi connata: *valvis* coriaceis, in medio loculi cujusque ab apice hiantibus. *Placentæ* 5, oblongæ, trigonæ, scrobiculatæ, columellæ (axi centrali) longitudinaliter adnatæ. *Semina* ... .

Frutex *Braziliensis; caulibus teretibus, densè cano-pilosis;* foliis *ovatis, acutis, integerrimis, petiolatis, 5-nerviis, subtùs sericeo-pilosis, suprà scabris;* pedunculis *terminalibus, ternis, trichotomis, trifloris, tomentosis;* floribus *magnis, roseis.*

1. D. canescens.

Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)

Obs. Genus ab singulari integumento calycis benè discriminatum est. Semina nondùm vidi, quòd capsulam esse immaturam, ideoque genus solùm habitu in hac sectione ordinandum. Nomen à διπλος, duplex, et στεγη, tectum, ab calyptrâ duplici calycis.

Rhexia, *Linn.*, *R. Brown.*

Rhexiæ sp. *Auctor.*

Calyx tubulosus, basi demùm amplians, ventricosus, apice in collo angustatus: *limbo* urceolato, 4-fido, persistente. *Petala* 4, in ore calycis insidentia, latè obovata. *Stamina* 8: *filamenta* longa, erecta, compressa, æqualia, in ore calycis intra petala inserta, inarticulata: *antheræ* lineares, declinatæ, obtusæ absque rostro, æquales, apice foramine hiantes, infra dorso nec basi filamenta insidentes, basi non constrictæ. *Ovarium* in ventro calycis liberum. *Stylus* rectus, teres staminibus brevior. *Stigma* parvum, subcapitatum, tenuissimè barbatum. *Capsula* globosa, in ventro calycis inclusa, libera, 4-locularis, 4-valvis: *valvis* rimâ oblongâ singulis in medio loculi hiantibus. *Placentæ* 4, lunatæ, pedicello brevi plano ad axem centralem adnato suffultæ, compressæ, valdè scrobiculatæ, in medio loculi centraliæ, seminibus creberrimè et imbricatìm tectæ. *Semina* ∞, reniformia, punctata, umbilico amplo concavo terminata: *testa* simplex crassiuscula, crustacea, fragilis: *albumen* nullum. *Embryo* teres, curvatus, lacteus: *cotyl.* breves semicylindricæ: *radicula* curvata, centripeta, cotyledonibus duplò longior.

Herbæ *læves, humiles* (*Boreali-Americanæ*), *perennes rariùs annuæ.* Caules *erecti, tetragoni, glabri.* Folia *opposita, sessilia, integerrima, linearia, lanceolata v. ovata.*

Flores *terminales*, *subterni* v. *multi*, *corymbosi*, *purpurei* aut *lutei magni*.

Ad hoc certè pertinent *Rhexia mariana* Linn., *virginica* Linn., *ciliosa* Mich., *glabella* Mich., *lutea* Mich., *stricta* Pursh, *angustifolia* Lam., excludendæ aliæ species ferè omnes ad hoc genus ab auctoribus adjunctæ, quas sunt Melastomæ affiniores, et fortè genus proprium constituere.

ARTHROSTEMMA, *Pavon MSS.*

RHEXIÆ sp., *Fl. Peruv.*

Calyx oblongus, tetragonus, tubulosus, æqualis, basi nudus, sæpiùs pilosus, limbo 4-fidus, persistens: *laciniis* lanceolatis, acutis aristatisque. *Petala* 4, lata, lateribus inæqualibus dolabriformia, apice obliquè aristata, basi unguiculata, in ore calycis margini circumambienti inserta. *Stamina* 8, eidem margini inserta: *filamenta* longa, gracilia, compressa, basi dilatata: *antheræ* incumbentes, longæ, compressæ, cariná magnâ dorso instructæ, apice foramine obliquo hiantes, basi processu longo calcarato clavato assurgente nunc apice tridentato munitæ, quasi filamenta duplici antherâ quarum una inanis et inaperiens prædita. *Ovarium* ovali-oblongum, setis pluribus coronatum, basi cum calyce connatum. *Stylus* teres, declinatus, basi latior. *Stigma* apex, obtusus, pruinosus. *Capsula* sicca, 4-locularis, 4-valvis, cum calyce connatum, et eidem æqualis: *valvis* latè oblongis medio cujusque loculi rimâ ab apice longitudinaliter dehiscentibus. *Dissepimenta* firma, medio valvarum inserta, columellæ tetragonæ adnata. *Placentæ* 4, lunatæ, valdè scrobiculatæ, imbricatè seminiferæ, basi latâ planâ axi adnatæ. *Semina* numerosa, reniformia, fulva v. fuscescentia, nunc lævia nunc papilloso-scabra, umbilico concavo magno atro terminata: *testa* simplex, crassa, crustacea, fragilis: *albumen* nullum. *Embryo* arcuatus semini conformis,

ochroleucus: *cotyl.* inæquales, crassæ, convexæ, applicatæ: *radicula* cylindracea, crassa, obtusa, cotyledonibus longior, curvata, vaga.

Herbæ v. suffrutices (*Amer. Æquin.* 1 *ex Nepaliâ*) *hirsuti, ramosi.* Folia *integerrima v. serrulata, 5-nervia, petiolata.* Flores *terminales, paniculati, purpurei v. rosei, speciosi.*

§ *Appendice antherarum apice tridentatâ.*

1. *A. ciliatum*, foliis cordatis utrinque lævibus margine serrulatis ciliatisque, caule herbaceo.
   Arthrostemma ciliatum, *Pavon MSS.*
   Hab. in Peruviâ. *Pavon.* ♃. (v. s. in Herb. Lamb.)
2. *A. làtifòlium*, foliis latè ovatis acuminatis serrulatis ciliatisque, paniculâ amplâ, antherarum appendice trisetosâ, caule fruticoso.
   Hab. in Guianâ. *Martin.* ♄. (v. s. in Herb. Lamb.)

§ *Appendice antherarum apice integrâ.*

Suffrutices.

3. *A. lineatum*, foliis lanceolatis integerrimis utrinque lineato-hirsutis, caule piloso.
   Rhexia sp. nov. *Pavon MSS.*
   Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)
4. *A. multiflorum*, foliis ovatis integerrimis utrinque cauleque hirsutissimis.
   Rhexia dicrananthera, *Fl. Peruv.* 3. p. 84. t. 320.
   Hab. in Peruviæ sylvis ad Cuchero et Muna. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)
5. *A. paniculatum*, foliis elliptico-oblongis acuminatis serrulatis coriaceis suprà nudis subtùs cauleque lanatis, paniculâ amplâ pyramidatâ, floribus cernuis.
   Rhexia paniculata, *Buchanan MSS.*

Hab. in Nepaliâ. *Buchanan*, *Wallich.* ♄. (v. s. in Herb. Lamb.)

Semina hujus minutissima, arcuata, scrobiformia, utrinque aristata. *Petala* obliquè mucronata.

Aciotis.

Calyx globosus, glaber, basi nudus: *limbo* parvo, coarctato, persistente, 4-dentato: *dentibus* ovatis, acutis aristatisque patente-recurvis. *Petala* 4, sessilia, ovato-oblonga, apice obliquè aristata, summo calycis inserta. *Stamina* 8, erecta, æqualia: *filamenta* gracilia, compressa, supra medium articulata: *antheræ* breviores, oblongæ, non rostratæ, poro simplici aperientes, dorso carinâ quòd in filamentum percurrente instructæ, basi nudæ. *Ovarium* globosum, calyce vestitum. *Stylus* teres, rectus, glaber, supernè curvatus et angustatus. *Stigma* punctum, minutum, pruinosum. *Capsula* calyce carnoso arctè connata, demùm baccata, purpurea, 4-locularis. *Placentæ* 4, lunatæ, succulentæ, scrobiculatæ, in quas semina nidulantia. *Semina* numerosa, parva, reniformi-globosa, fusca, papilloso-scabra, umbilico magno concavo terminata: *testa* duplex; exterior crassiuscula, crustacea, fragilis; interior tenuissima, membranacea: *albumen* nullum. *Embryo* albus, arcuatus, teres, semini conformis: *cotyl.* breves, crassæ, inæquales: *radicula* cylindracea, attenuata, cotyledonibus multò longior, centripeta.

Herba (*Indiæ Occid.*) *perennis*, *glabriuscula*, *virens*. Caules *erecti*, *plures*, *tetragoni*, *spithamei*, *ramosi*. Folia *elliptico-oblonga*, *acuminata*, *petiolata*, *3-nervia*, *subtùs purpurea*, *suprà intensè viridia lucida*. Flores *terminales*, *spicato-racemosi*, *parvi*, *rosei*. Baccæ *globosæ*, *purpurei*, *grati acidi edules*.

Obs. Genus valdè distinctum, cui pertinet Rhexia bicolor *Anderson MSS.* Nomen duxi ab ἀκις, *cuspis*, et οὖς, ὠτος, *auris*, quòd petala apice aristata.

1. A. discolor.
   Hab. in Insulâ S. Vincentii. *Andersoñ.* ♃. (v. v. c. et s. spont. in Herb. Lamb.)

Microlicia.

Calyx globosus, glaber v. setosus, basi nudus, limbo 5-partitus, persistens: *segmentis* lineari-lanceolatis, mucronatis, rectis. *Petala* 5, obovato-oblonga, in ore calycis inserta, basi angustata, apice obliquè mucronulata, lateribus inæqualibus subdolabriformia. *Stamina* 10, in calycis ore inserta: *filamenta* longa, recta, compresso-plana, glabra: *antheræ* oblongæ, carinatæ, apice membranaceæ, poro simplici obliquo dehiscentes, stipite longissimo filiformi cujus basi processu simplici calcarato instructâ filamenta propria incumbente suffultæ. *Ovarium* globosum calyce tectum. *Stylus* teres, declinatus, filiformis, stamina subæquans. *Stigma* punctum, pruinosum. *Capsula* sicca, calyce liberè inclusa et eodem brevior, 3-locularis, 3-valvis! apice umbilicata: *valvis* oblongis v. ovalibus, tenuibus, apice emarginatis, medio loculorum singulorum a rimâ longitudinali trifariam dehiscens. *Dissepimenta* membranacea, valvarum medio inserta, columellæ filiformi leviùs connexæ. *Placentæ* 3! lunatæ, angustæ, subtrigonæ, scrobiculatæ, axi centrali adnatæ, imbricatè seminiferæ. *Semina* numerosa, oblonga, arcuata, rufa, punctata: *testa* simplex, crassiuscula, crustacea: *albumen* nullum. *Embryo* arcuatus, semini conformis, teres, lacteus: *cotyl.* semicylindraceæ, crassæ, breves, inæquales: *radicula* cylindracea, cotyledonibus duplò longior, curvata, vaga.

Fruticuli (*Brazilienses*), *ramosissimi, erecti, foliosi facie ericoideâ.* Folia *omnium ordinis minima, linearia v. lanceolata aut ovalia, opposita, sessilia, integerrima, glabra aut pubescentia, nunc imbricata nunc laxa.* Flores *terminales, subsolitarii, purpurei, majusculi.*

Obs. Genus verè naturale et quidèm nullo affine, cujus species inter se optimè convenientes. Singularis est exceptio in ordine, quòd flores utpotè 5-fidi decandri capsulam trilocularem redderent. Nomen desumpsi à μικρος, *parvus*, et ηλικια, *statura*, propter species hujus generis omnes humillimi fruticuli sunt.

1. *M. ericoides*, foliis linearibus mucronatis planis laxis, floribus geminis, calycibus glabris.
   Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)
   Caules numerosi, adscendentes, palmares, tetragoni, subsimplices, cæspitosi, e radice crassiusculâ fibris instructâ enati.

2. *M. cupressina*, foliis lanceolatis pungentibus crebris imbricatis marginatis, floribus solitariis, calycibus hispidis.
   Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)
   Caules erecti, ramosissimi, spithamei. *Rami* teretes, graciles, proliferi, supernè crebrè foliosi, infernè nudi.

3. *M. serpyllifolia*, foliis ellipticis acutis patentibus utrinque ramulisque pubescentibus, floribus solitariis pedicellatis, calycibus pubescentibus.
   Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)
   Caulis erectus, ramosissimus. *Rami* tetragoni, densè pubescentes. *Folia* elliptica, acuta, integerrima, plana, patentia, obsoletè trinervia, utrinque pubescentia, magnitudine *Thymi serpylli.* *Flores* purpu-

rei, terminales et axillares, solitarii, pedicellis brevissimis teretibus suffulti.

4. *M. linophylla*, foliis lanceolatis aristatis planis integerrimis trinerviis glabris, floribus solitariis subsessilibus terminalibus axillaribusve.

Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)

Fruticulus erectus, ramosissimus, pedalis, virgatus. *Rami* ramulique viminei, tetragoni, glabri. *Folia* patentia, lanceolata, integerrima, plana, trinervia, glabra, aristata. *Flores* terminales et axillares, purpurei, brevissimè pedicellati, erecti. *Calyces* glabri.

5. *M. marifolia*, foliis decussatis ovatis obtusiusculis trinerviis brevè petiolatis utrinque ramisque pubescentibus, floribus axillaribus solitariis pedicellatis.

Hab. in Braziliâ. *Sello.* ♄. (v. s. in Herb. Sims.)

Fruticulus erectus, ramosissimus, foliosus, spithameus. *Rami* tetragoni, densè pubescentes. *Folia* decussata, ovata, obtusiuscula, 3-nervia, obsoletè crenulata, utrinque pubescentia. *Flores* sparsi, solitarii. *Calyces* pubescentes.

Tococa, *Aubl.*, *Juss.*

Mayeta, *Aubl.*, *Juss.*
Melastomæ sp. *Auctor.*

Calyx oblongus, tubulosus, basi extùs nudus v. squamis 5 munitus: *limbo* urceolato, persistente, coriaceo, 5-dentato. *Petala* 5, subrotunda, emarginata, margine superiore inflexa, basi ungue brevissimo lato in ore calycis margini annulari inserta. *Stamina* 10, declinata, æqualia, eidem margini inserta: *filamenta* linearia, compresso-plana, glabra,

v. (in *T. sanguineâ*) glandulosa, basi parùm latiora: *antheræ* longissimæ, subulatæ, trigonæ, carinâ latâ crassâ auctæ, anticè canaliculatæ, apice non rostratæ, foramine solitario terminatæ, basi filamentis adfixæ, posticè biauriculatæ. *Ovarium* subrotundo-ovatum, calyce obtectum, apice coronâ urceolatâ fimbriatâ instructum. *Stylus* filiformis, glaber aut (in *T. sanguineâ*) densè glandulosus, elongatus, declinatus aut (in *T. Mayetâ*) brevis, rectus. *Stigma* magnum, orbiculato-peltatum, umbilicatum. *Capsula* baccata, 5-locularis, 5-valvis, medio cujusque loculi a rimâ longitudinali quinquefariam dehiscens. *Placentæ* 5, magnæ, pulposæ, loculis conformes. *Semina* numerosa, ovata, fuscescentia, umbilico magno crasso laterali convexo nigro aucta, in placentis pulposis nidulantia: *testa* duplex; exterior crassiuscula, crustacea, fragilis; interior tenuissima, membranacea: *albumen* nullum. *Embryo* rectus, semini conformis, ovoideus, luteus: *cotyl.* æquales, crassæ, plano-convexæ, ovales, obtusæ: *radicula* cylindracea, crassa, cotyledonibus brevior, obtusa, recta.

Frutices (*Amer. Æquin.*) *hispidi, erecti.* Folia *crenulata, 3 aut 5-nervia, sæpiùs disparia.* Petioli *breves, valdè setosi, supernè tumidi et inflati in vesicâ magnâ biloculari medio constrictâ subtùs in divisuris nervorum foliorum duplici foramine hiante.* Flores *rosei aut albi, paniculati v. spicato-paniculati, terminales, in* T. Mayetâ *axillares, solitarii, sessiles.*

Obs. Vesicæ supra petiolos planè opus formicarum, quas ab geminâ aperturâ (observante Aubletio) ad cavum caulinum penetrant. In his vesicis jam in siccis formicas extinctas ipse sæpissimè inveni.

1. *T. Aubletii*, foliis latè ovalibus oblongisve acuminatis crenulatis 5-nerviis æqualibus, utrinque cauleque

hispidè setosis, petiolis supernè inflatis, paniculâ terminali spicatâ.

Tococa Gujanensis, *Aubl. Guj.* p. 438. t. 174.

Melastoma physiphora, *Vahl, Eclog.* 1. p. 45. *Willd. Sp. Pl.* 2. p. 590.

Hab. in Guianâ (*Aublet, Martin*), in Braziliâ. *Newmann, Sello.* ♄. (v. s. in Herb. Lamb.)

2 *T. heterophylla*, foliis disparibus crenulatis 3-nerviis acuminatis utrinque ramisque setosis; alteris maximis elliptico-oblongis petiolo supernè vesiculosis; alteris sessilibus cordatis, paniculis hispidissimis terminalibus axillaribusque.

Melastoma heterophylla, *Lam. Encycl.* 4. p. 35. *Willd. Sp. Pl.* 2. p. 590.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Folia altera maxima, palmaria v. pedalia, petiolata, 3-5-pollicis lata; altera sessilia, vix 3-pollicaria. *Stylus* staminibus longior.

3. *T. sanguinea*, foliis cordato-ovalibus acuminatis 5-nerviis crenulatis utrinque cauleque densè setosis, petiolis simplicibus, paniculâ brachiatâ, calycibus basi squamosis, filamentis styloque densè glandulosis.

Melastoma sanguinea, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Tota planta setis sanguineis tecta. *Folia* sæpè palmaria, 3-4-pollicis lata. *Filamenta* brevia, compressa, densè glandulosa. *Stylus* brevis, rectus, robustus, glandulosus.

4. *T. Mayeta*, foliis disparibus elliptico-oblongis acuminatis crenatis 3-nerviis utrinque cauleque hispidè setosis; alteris maximis petiolo supernè vesiculosis, floribus axillaribus solitariis sessilibus basi 5-squamosis.

Mayeta Gujanensis, *Aubl. Guj.* p. 443. t. 176.
Melastoma Mayeta, *Willd. Sp. Pl.* 2. p. 589.
Hab. in Guianâ (*Aublet*), in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)
Stylus staminibus brevior, rectus.

Clidemia.

Melastomæ sp. *Auctor.*

Calyx oblongus, tubulosus, densè setosus v. hirsutus, basi squamis pluribus cinctus aut nudus, limbo persistens, 5-dentatus: *dentibus* sæpiùs linearibus, plumosis, rectis. *Petala* 5, subrotunda v. oblonga, obtusa, sessilia, in summo tubo calycis inserta. *Stamina* 10, subæqualia, declinato-assurgentia: *filamenta* subulata, compresso-plana, glabra, apice acuta: *antheræ* longæ, angustæ, subtrigonæ, carinatæ, basi biauriculatæ, filamentis adfixæ, apice membranaceæ, poro unico aperientes. *Ovarium* subrotundum, calyce inclusum, apice glabrum, rostro umbilicato coronatum. *Stylus* filiformis, gracilis, declinatus, sæpiùs staminibus longior. *Stigma* punctum parvum, pruinosum. *Capsula* baccata, subrotunda, calyce vestita et cum eo arctè connata, apice rostrato-umbilicata, coronata denticulis persistentibus calycis, 5-locularis, 5-valvis, medio cujusque loculi a rimâ longitudinali quinquefariam dehiscens: *loculis* singulis intùs placentâ pulposâ in quâ nidulantia semina farctis. *Semina* numerosa, subrotundo-ovalia, rufa, papilloso-scabra, raró lævia, umbilico magno convexo laterali quandoque arcuato, utrinque acuto aucta: *testa* duplex; exterior crassiuscula, crustacea, fragilis; interior tenuissima, membranacea: *albumen* nullum. *Embryo* lacteus, teres, curvulus, cavitati seminis conformis: *cotyl.* subæquales, brevissimæ, crassæ,

rotundatæ: *radicula* cylindracea, crassa, obtusa, cotyledonibus longior, centripeta.

Suffrutices (*Amer. Æquin.*) *hirsutissimi*. Rami *tetragoni*. Folia *crenata petiolata, 3 v. 5-nervia, sæpè disparia*. Flores *axillares v. terminales, albi aut rosci, verticillati aut variè dichotomi, sæpiùs in paniculam v. racemum digesti, nunc sessiles*. Baccæ *succulentæ, purpureæ v. coccineæ, grati dulcis saporis edules*.

Obs. Hoc genus distinctissimum in memoriam dixi *Clidemii* Botanices antiquæ Græciæ, cujus cognitio in rem Herbarii a Theophrasto memorata.

1. *C. neglecta*, foliis amplis cordatis acuminatis crenatis septemnerviis utrinque cauleque asperè hirsutissimis, spicis elongatis axillaribus cernuis simplicibus v. compositis, calycibus basi 5-squamosis.

   Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

2. *C. dependens*, foliis ellipticis crenatis acuminatis 3-nerviis utrinque cauleque hirsutissimis, spicis terminalibus cernuis, calycibus sessilibus basi 5-squamosis.

   Melastoma dependens, *Pavon MSS.*

   Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

3. *C. dichotoma*, foliis amplis ovatis acuminatis serratis 7-nerviis subtus cauleque villosissimis, paniculâ terminali racemosâ.

   Melastoma dichotoma, *Pavon MSS.*

   Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

4. *C. tristis*, foliis cordato-oblongis crenulatis acuminatis 5-nerviis suprà asperè pilosis subtùs fusco-lanatis, paniculâ terminali lanatâ.

   Melastoma tristis, *Pavon MSS.*

   Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

5. *C. crenata*, foliis cordato-oblongis acutis 3-nerviis crenulatis utrinque cauleque asperè pilosissimis, paniculâ terminali amplâ, calycibus sessilibus, basi squamosis.

Melastoma crenata, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

6. *C. purpurea*, foliis latè ellipticis acuminatis crenulatis 5-nerviis cauleque hirsutis subtùs purpureis, pedunculis axillaribus trichotomis trifloris.

Melastoma purpurea, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

7 *C. pilosa*, foliis cordatis acuminatis crenulatis 7-nerviis utrinque cauleque pilosissimis, paniculâ parvâ terminali, pedunculis subtrifloris.

Melastoma pilosa, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

8. *C. capillaris*, foliis ellipticis crenulatis 3-nerviis acuminatis utrinque ramulisque sericeo-villosis, pedunculis capillaribus axillaribus geminis unifloris.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

9. *C. spicata*, foliis latè ellipticis crenulatis triplinerviis utrinque acutis subtùs ramisque sericeo-villosis, racemo terminali spicato, pedunculis trifloris.

Melastoma spicata, *Pavon MSS.* an *Aubl. Guj.* t. 165?

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

10. *C. secunda*, foliis ovatis acuminatis 5-nerviis crenulatis basi rotundatis utrinque cauleque pilosissimis, paniculâ terminali divaricatâ, pedunculis unilateralibus bifidis multifloris.

Melastoma secunda, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

11. *C. dentata*, foliis ovalibus crenatis acuminatis 5-ner-

viis utrinque cauleque asperè hirsutis, pedunculis axillaribus brevibus trichotomis multifloris.

Melastoma dentata, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

12. *C. ciliata*, foliis cordatis acutis crenulatis subsessilibus suprà pilosis subtùs ramisque densè stellato-tomentosis, pedunculis axillaribus, calycibus tomentosis.

Melastoma ciliata, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

13. *C. agrestis*, foliis ovato-lanceolatis acuminatis 5-nerviis crenulatis utrinque cauleque villosissimis, paniculâ terminali, pedunculis bifidis multifloris.

Melastoma agrestis, *Aubl. Guj.* p. 425. t. 166. *Willd. Sp. Pl.* 2. p. 587.

Hab. in Guianâ. *Aublet.* ♄.

14. *C. hirta*, foliis ovato-lanceolatis acuminatis 5-nerviis crenulatis utrinque cauleque asperè pilosis, floribus axillaribus aggregatis brevè pedicellatis.

Melastoma hirta, *Mill. Dict.* N. 3. *Swartz Obs.* 175. *Willd. Sp. Pl.* 2. p. 588.

Hab. in Jamaicâ. *Swartz, Dancer.* ♄. (v. s. in Herb. Lamb.)

15. *C. elegans*, foliis cordatis inæqualiter crenatis 5-nerviis acuminatis utrinque cauleque asperè pilosissimis, pedunculis axillaribus trichotomis divaricatisque multifloris.

Melastoma elegans, *Aubl. Guj.* p. 427. t. 167. *Vahl Eclog.* 1. p. 44. *Willd. Sp. Pl.* 2. p. 589.

Hab. in Guianâ (*Aublet, Anderson*), in Insulâ S. Trinitatis. *Lochhead.* ♄. (v. s. in Herb. Lamb.)

16. *C. aggregata*, foliis ellipticis 3-nerviis integerrimis

utrinque acutis ramisque hispidè pilosis, floribus axillaribus verticillatis subsessilibus.

Melastoma aggregata, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

17. C. *sericea*, foliis ovalibus acutis crenatis 5-nerviis utrinque sericeo-villosis, floribus axillaribus sessilibus verticillatis basi squamosis.

Melastoma sericea, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

18. *C. heteromalla*, foliis ellipticis subsessilibus crenulatis suprà pilosis subtùs cano-tomentosis, floribus axillaribus subsessilibus verticillatis octandris.

Melastoma rubra, *Richard in Bonpl. Monog.* p. 89. t. 39. (exclus. *synon.*)

Hab. in Guianâ (*Richard*), in Indiâ Occidentali (*Dancer*), in Insulâ S. Trinitatis (*Lochhead*). ♄. (v. s. in Herb. Lamb.)

19. *C. capitellata*, foliis cordato-ovalibus acuminatis crenatis 5-nerviis suprà pilosis subtùs petiolisque tomentosis, floribus glomeratis in spicâ racemosâ interruptâ dispositis, calycibus lanatis.

Melastoma capitellata, *Bonpl. Monog.* p. 5. t. 3.

Hab. in Regno Novogranatensi. *Humb. et Bonpl.* ♄. (v. s. in Herb. Lamb. specim. a clariss. Bonpland. communicata.)

CREMANIUM.

Calyx brevis, campanulatus, coriaceus, basi nudus, extùs glaber aut setis hispidus: *limbo* urceolato, persistente, 4 v. 5-dentato: *dentibus* brevissimis, remotis. *Petala* 4 v. 5, orbiculata, sessilia, in ore calycis margini annulari inserta.

Stamina 8-10, declinata, æqualia: *filamenta* subulata, compressa, glabra aut hispida, basi dilatata: *antheræ* totius ordinis brevissimæ, subcuneatæ, crassæ, basi nudæ, dorso carinatæ, apice obtusæ, duplici foramine hiantes! *Ovarium* sphæricum, calyce arctè connatum. *Stylus* cylindraceus, glaber, declinatus v. erectus. *Stigma* orbiculato-peltatum, disco umbilicatum sulcis duobus cruciatum. *Capsula* baccata, globosa, 4-locularis, 4-valvis, quandoque 5-locularis, 5-valvis, calyce coriacea vestita et arctè connata. *Placentæ* 4 v. 5, oblongæ, latæ, carnosæ, valdè scrobiculatæ, imbricatè seminiferæ. *Semina* numerosa, subrotundo-ovalia v. oblonga, luteo-fusca, glabra, sæpiùs nitida, umbilico laterali magno convexo pallido aucta: *testa* duplex; exterior crassiuscula, crustacea; interior membranacea: *albumen* nullum. *Embryo* rectus, ochroleucus, ovoideus, cavitati seminis conformis: *cotyl.* breves, crassæ, obtusæ: *radicula* cylindracea, cotyledonibus longior, curvula, basi attenuata.

Frutices (*Peruviani*) *ramosi, patentes et radicantes v. scandentes,* alii *erecti, glabri aut hispidi.* Folia *petiolata, coriacea, dentata v. serrulata rarò integerrima, 3 v. 5-nervia, quandoque enervia!* Flores *terminales, thyrsoideo-racemosi v. paniculati, albi, sæpius nutantes.*

Obs. Genus habitum Blakeæ æmulans, et antheræ pariter duplici aperturâ hiantes, sed longè recidet calyce basi nudo, stigmate lato peltato, antheris basi nudis et inflorescentiâ. Nomen desumpsi à κρεμάω, *suspendo,* propter plures frutices hujus generis per arbores scandentes et flores sæpè pendulos.

§ *Flores octandri.*

1. C. *rotundifolium,* foliis orbiculato-cordatis integerrimis utrinque hispidis, floribus subquaternis brevè pedicellatis, ramis tomentosis, caule repente.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Fruticulus ramosus, repens, radicans. *Folia* orbiculato-cordata, integerrima, coriacea, petiolata, utrinque pilis setosis hispida, viridia. *Flores* pauci (3-4) ad apicem ramorum, brevè pedicellati, magni, albi. *Pedicelli* bracteolis 2 parvis linearibus instructi. *Filamenta* hispida.

2. C. *nitidum*, foliis ovatis acutis glabris nitidis margine subulato-dentatis, racemis glabris nutantibus, caule radicante.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex patens, repens. *Rami* teretes, glabri. *Folia* 3-nervia. *Flores* majusculi, albi. *Filamenta* glanduloso-pilosa, basi latè dilatata.

3. C. *thyrsiflorum*, foliis lanceolatis acutis integerrimis glabris nitidis subtùs ad nervos pilosis, floribus cernuis in thyrso composito confertis, ramis tomentosis, caule radicante.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex patens, repens. *Rami* fusco-tomentosi. *Folia* 3-nervia. *Flores* numerosi, albi, præcedente triplò minores, cernui, in thyrso composito suberecto conferti.

4. *C. latifolium*, foliis cordato-ovatis acutis serrulatis suprà nudis lucidis subtùs ramulisque pilosis, paniculâ terminali multiflora.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Flores parvi, albi.

5. *C. vaccinioides*, foliis ovalibus obtusis trinerviis integerrimis ramulisque glabris, floribus cernuis pedicellatis terminalibus subquinis axillaribusque solitariis.

Melastoma vaccinioides, *Bonpl. Monog.* p. 15. t. 8.

Hab. in Peruviæ Andibus. *Humb. et Bonpl.* ♄. (v. s.

in Herb. Lamb. specim. a clariss. Bonpl. communicata.)

Frutex suborgyalis ramosissimus, confertè foliosus. *Folia* parvula, ferè *Buxi*. *Flores* majusculi, albi, octandri.

§ *Flores decandri.*

6. *C. medium*, foliis ellipticis acutis serrulatis suprà nudis lucidis subtùs ramulisque pilosis, thyrsis compositis.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex erectus. *Flores* cernui, parvi, albi.

7. *C. calophyllum*, foliis cuneato-oblongis coriaceis glabris integerrimis marginatis suprà nitidissimis subtùs penninerviis et pulchrè reticulatis, paniculâ terminali ramosissimâ.

Melastoma obovata, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex erectus, foliis pulcherrimis, *Myrtaceis* quibusdam simillimus. *Flores* albi omnium minimi. *Stylus* staminibus duplò brevior. *Stigma* peltatum.

8. *C. laurinum*, foliis lanceolatis obtusis integerrimis 3-nerviis suprà glabris subtùs ramulisque pilosis, paniculâ racemosâ.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex erectus. *Flores* albi, parvi, cernui.

9. *C. cœruleum*, foliis lanceolatis acuminatis integerrimis 3-nerviis suprà asperis subtùs ramulisque pilosissimis, paniculâ brachiatâ hispidâ.

Melastoma cœrulea, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex scandens? *Flores* minimi, albi. *Stylus* staminibus duplò longior. *Baccæ* parvæ, globosæ, cœruleæ.

10. *C. cœleste*, foliis ovato-lanceolatis acuminatis crenulatis 3-nerviis subtùs ramulisque pulverulentis, paniculâ brachiatâ, floribus glomeratis.
Melastoma cœlestis, *Pavon MSS.*
Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)
Frutex erectus. *Flores* parvi, albi. *Stylus* staminibus duplò longior.

11. *C. serrulatum*, foliis elliptico-oblongis acutis serrulatis 3-nerviis glabris, paniculâ brachiatâ, floribus glomeratis, stylo staminibus duplò breviore.
Melastoma serrulata, *Pavon MSS.*
Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)
Frutex erectus. *Flores* parvi, lactei.

Centronia.

Calyx oblongus, tubulosus, undique setis retrorsùm deflexis densè vestitus: *limbo* brevi, coarctato, integro! *Petala* 5, subrotunda, margini annulari infra limbum calycinum inserta. *Stamina* 10, eidem margini infra petala inserta: *filamenta* brevissima, lata, plana: *antheræ* longissimæ, subcompressæ, carinatæ, erectæ, apice in rostro attenuatæ, poro unico hiantes, basi processu longo subulato acutissimo instructæ. *Ovarium* ovatum, calyce inclusum, 8-10-costatum, apice in collo longo tubuloso, ore octodentato, stylum ipsum includente elongatum! *Stylus* erectus, teres, supernè angustatus. *Stigma* apex obtusus, pruinosus, vaginam superans, sed limbo calycis brevior. *Capsula* 5-locularis, 5-valvis, calyce tecta, sed libera. *Placentæ* 5, oblongæ, crassæ, trigonæ, sublunatæ, scrobiculatæ, axi centrali adnatæ. *Semina*..............

Arbor (*Peruviana*) *ramulis densè ferrugineo-tomentosis.* Folia *ampla, opposita, petiolata, elliptica, acuminata, inte-*

gerrima, coriacea, penninervia, reticulato-venosa; suprà glabra, nitida, subtus in junioribus *fusco-tomentosa, demùm denudata.* Panicula *terminalis, magna, brachiata.* Flores *magni, purpurei.* Calyces *valdè setosi.*

Obs. Nomen desumpsi à κεντρον, *stimulus*, quòd antheræ posticè calcare longo acutissimo instructæ.

1. C. laurifolia.
Osbeckia peruviana, *Pavon MSS.*
Hab. in Peruviæ nemoribus. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Miconia, *Ruiz et Pavon.*

Melastomæ magna pars *Auctor.*

Calyx brevis, tubulosus: *limbo* 5-dentato urceolato, persistente: *dentibus* brevissimis, acutis, apice intùs membranâ obtusâ ipsis latiore auctis. *Petala* 5, oblonga, obtusa calycis ori inserta. *Stamina* 10, erecta: *filamenta* longa, linearia, compressiuscula, apice curvata: *antheræ* longæ, declinato-curvatæ, subulatæ, carinâ dorsali crassâ obtusâ apice poro hiantes, basi filamentis adnatæ, auriculo crasso obtuso auctæ. *Ovarium* calyce obvolutum. *Stylus* teres, staminibus longior, rectiusculus, supernè curvatus. *Stigma* parvum, planiusculum, tenuissimè barbatum. *Capsula* baccata, globosa, glabra, 5-locularis, 5-valvis, calyce arctè connata, limbo calycino persistente coronata: *valvis* in medio cujusque loculi rimâ oblongâ hiantibus. *Dissepimenta* 5, membranacea, medio valvarum inserta, axi centrali adnata, utrinque simul cum parietibus capsulæ lacunosa, imbricatè seminifera. *Placentæ* 5, succulentæ, latæ, oblongæ, scrobiculatæ, angulis columellæ adfixæ, imbricatè seminiferæ. *Semina* numerosa, parva, ovata, angulata, umbilico oblongo convexo crasso laterali nigro aucta:

testa duplex; exterior crustacea, fragilis; interior tenuissima, membranacea: *albumen* nullum. *Embryo* ochroleucus, rectus, cavitati seminis conformis: *cotyl.* crassæ, obtusæ, æquales: *radicula* teres, attenuata, cotyledonibus longior, recta.

Frutices (*Americæ Æquin. et Indiæ Occid.*) *ramosi, sæpiùs elati, ramis oppositis.* Folia *petiolata, opposita, in plerisque crenulata vel remotè denticulata, sæpiùs glabra.* Flores *numerosi, terminales, paniculati, rosei vel albi.*

Obs. Præter *Miconia emarginata* R. P., *triplinerviis* R. P., *pulverulenta* R. P., *lanuginosa* R. P.

Hùc referendæ quidem species sequentes *Melastomæ*, scilicet, *M. Guayaquilensis* Bonpl. Monog. t. 49, *M. punctata* Rich. in Bonpl. Monog. t. 40, *M. impetiolaris* Rich. in Bonpl. Monog. t. 29, *M. tomentosa* Bonpl. Monog. t. 16, et multas alias præter ineditas.

Conostegia.

Melastomæ sp. *Auctor.*

Calyx coriaceus, glaber: *tubo* campanulato: *limbo* indiviso calyptræformi figurâ omninò coni umbonati, in æstivatione genitalia et petala tegente, demùm ad explicationem floris è tubo circumrepente et integrum decedente. *Petala* 5-8, in tubi ore circumambienti margini affixa. *Stamina* 10-16, erecta: *filamenta* gracilia, compressa, eidem margini inserta: *antheræ* lineari-oblongæ, carinatæ, trigonæ, basi brevè cornutæ filamentis affixæ, apice poro hiantes. *Ovarium* globosum calyce arctè connatum. *Stylus* teres, rectiusculus, staminibus brevior, apice curvulus, incrassatus. *Stigma* obtusum, planiusculum, pruinosum. *Capsula* baccata, globosa, glabra, 8-locularis, calyce truncato-obvoluta et arctè connata, summo umbilicata. *Dissepimenta* 8, coriacea, medio valvarum

inserta, axi centrali adnata, utrinque simul cum parietibus capsulæ lacunosa, imbricatè seminifera. *Placentæ* veræ nullæ, sed loculi capsulæ pulpâ molli (in quâ semina nidulantia) farcti. *Semina* numerosa, ovato-oblonga, minutissima, lutescentia, umbilico lato oblongo plano laterali notata: *testa* duplex; exterior crustacea, valdè fragilis; interior tenuissima, membranacea: *albumen* nullum. *Embryo* rectus, semini conformis, albus: *cotyl.* æquales, semicylindricæ, crassæ: *radicula* cylindracea, cotyledonibus longior, basi attenuata.

Arbores *v.* frutices (*Amer. Æquin. et Insular. Societat.*) *erectæ*, *ramosæ*. Folia *petiolata*, *opposita*, *integerrima* v. *crenata*. Flores *terminales*, *paniculati*, *albi*.

Hùc *Melastoma glabra* Forst., *procera* Swartz, Bonpl. Monog. t. 51, *montana* Swartz, *superba* Bonpl. ined., *extinctoria* Bonpl. Monog. t. 57, *Xalapensis* Bonpl. Monog. t. 54, *calyptrata* Lam. Encycl. Bonpl. Monog. t. 46, *cucullata* Pavon MSS., *holosericea* Pavon MSS.

Obs. Distinctissimum et figurâ calycis admodùm singulari benè notatum genus; ab Miconiâ cui habitu convenit calycis formâ, staminum numero, capsulâ 8-loculari, dissepimentis alternis contiguis cum receptaculis longè distat. Nomen deduxit è κῶνος, *conus*, et στέγη, *tectum*, ab formâ singulari calycis.

Chitonia.

Fothergilla, *Aubl.*
Melastomæ sp. *Auctor.*

Calyx tubulosus, coriaceus, extùs canus, basi instructus squamis duabus cuneatis sæpè latis in æstivatione conniventibus et ferè totum florem includentibus: *limbo* urceo-

lato, coriaceo, 5-dentato, persistente. *Petala* 5, lineari-oblonga, summo tubo calycis inserta. *Stamina* 10: *filamenta* erecto-adscendentia, compresso-plana,: *antheræ* longissimæ, subulatæ, carinatæ, declinatæ, basi constrictæ, biauriculatæ, filamenta insidentes, apice rostratæ, adscendentes, poro hiantes. *Ovarium* liberum, sulcatum, apice tomentosum. *Stylus* rectus, teres, staminibus brevior. *Stigma* crassiusculum, peltatum. *Capsula* subrotunda, baccata, 5-locularis, 5-valvis, calyce obvoluta, basi ejus connata: *valvis* rimâ oblongâ in medio cujusque loculi hiantibus. *Dissepimenta* membranacea, medio valvarum affixa et facilè separabilia, axi centrali adnata. *Placentæ* 5, oblongæ, rugosæ, scrobiculatæ, axi centrali longitudinalitèr affixæ. *Semina* subrotunda v. oblongo-ovata, nigro-fusca, lævia aut papilloso-scabra, umbilico magno convexo laterali aucta: *testa* duplex; exterior crassa, crustacea; interior tenuis, coriacea. *Embryo* ovoideus, rectus, ochroleucus: *cotyl.* crassæ, obtusæ, plano-convexæ: *radicula* cylindracea, cotyledonibus longior, recta.

Frutices (*Indiæ Occid. et Guianæ*) *elati, speciosi, ramis oppositis densè tomentosis.* Folia *elliptica* v. *lanceolata, crenulata, opposita, petiolata, 5-nervia, basi rotundata, suprà nuda, subtùs sæpè fusco-tomentosa.* Flores *terminales, numerosi, paniculati, albi aut albo-carnei raro aurei.*

Ad hoc genus pertinent sequentes species.

1. *C. Fothergilla*, foliis ovato-lanceolatis acuminatis 5-nerviis basi rotundatis margine crenulatis subtùs fusco-tomentosis, paniculâ terminali subracemosâ cano-tomentosâ.

Fothergilla mirabilis, *Aubl. Guj.* 2. p. 441. t. 175.

Melastoma Fothergilla, *Rich. in Bonpl. Monog.* p. 71. t. 32.

Melastoma Tamonea, *Sw. Prod.* ejusd. *Fl. Ind. Occid.*

Melastoma Swartziana, *Rich. in Bonpl. Monog.* p. 74. t. 33.

Hab. in Guianâ (*Aublet*), in Jamaicâ (*Swartz*).

Arbor elegans, 10-15-pedalis. *Flores* albo-carnei.

2. *C. caudata*, foliis latè ellipticis integerrimis 5-nerviis apice longè cuspidatis, floribus glomerato-paniculatis.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

3. *C. aurea*, foliis ovato-lanceolatis acuminatis triplinerviis integerrimis basi acutis utrinque glabris, paniculâ pyramidatâ lævi.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Flores aurei.

4. *C. bubalina*, foliis ovato-lanceolatis dentatis acuminatis 5-nerviis subtùs ramulisque fulvo-tomentosis, paniculâ multiflorâ, calycibus cano-tomentosis.

Melastoma bubalina, *Pavon MSS.*

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Folia sæpè pedalia, 4-uncialis lata. *Flores* parvi.

5. *C. macrophylla*, foliis cordato-ovalibus acuminatis crenulatis subtùs ramulisque fulvo-tomentosis, paniculâ pyramidatâ, calycibus sulcatis.

Melastoma macrophylla, *Pavon MSS.*

Hab. in Mexico. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Folia palmaria v. pedalia, latitudine 3-5-pollicari.

Obs. Nomen è χιτων, *tunica*; quòd calyces in æstivatione ferè obvoluti duplici squamâ cuneatâ.

Axinæa, *Ruiz et Pavon.*

Calyx cyathiformis, glaber, basi nudus: *limbo* persistente, obsoletè denticulato. *Petala* 5-6, orbiculata, subcoriacea, sessilia, in calycis ore margini circumambienti insidentia.

Stamina 10-12 eidem margini inserta: *filamenta* brevia, æqualia, compresso-plana, basi dilatata: *antheræ* longæ, valdè declinatæ, carinatæ, subtrigonæ, apice obtusæ absquè rostro, poro gemino hiantes, basi in calcare longiùs productæ, infrà ad latus internum filamentis adnatæ. *Ovarium* globosum, liberum. *Stylus* incurvus, crassiusculus, staminibus multò brevior. *Stigma* simplicissimum, obtusum. *Capsula* globosa, sicca, 5-6-locularis, 5-6-valvis, calyce coriaceo laxè obvoluta, et eundem superans, angulis 5-6 corniculatis coronata: *valvis* coriaceo-crustaceis, rimâ oblongâ singulis in medio loculi hiantibus. *Dissepimenta* crassiuscula, crustacea, valvarum medio inserta, axi centrali adnata. *Placentæ* 5-6, oblongæ, crassæ, subtrigonæ, valdè rugosæ et scrobiculatæ, axi centrali longitudinalitèr adnatæ. *Semina* ovata, fusca, punctata, umbilico oblongo convexo laterali aucta: *testa* duplex; exterior crassa, crustacea; interior membranacea: *albumen* nullum. *Embryo* rectus, cavitati seminis conformis: *cotyl.* crassæ, hemisphæricæ, æquales: *radicula* cylindracea, crassa, obtusa, cotyledonibus longior.

Arbores *aut* frutices (*Peruviæ*) *frondosæ.* Folia *ovato-lanceolata* v. *latè cordata, coriacea, dentata* v. *crenata, 5-nervia, reticulatim venosa, opposita, petiolata, suprà rugosa* v. *plana nuda, subtùs tomento brevissimo fusco tecta.* Flores *terminales, corymbosi* v. *subracemosi, magni, purpurei aut albi.*

Obs. Hùc species sequentes, scilicet:

1. *A. purpurea*, foliis cordatis 7-nerviis crenatis reticulato-venosis suprà rugosis scabris subtùs lacunosis fusco-tomentosis, pedunculis unifloris corymbosis.

Axinæa purpurea, *R. P. Syst. Veg. Fl. Per. et Chil.* 1. p. 122.

Ibid. *Fl. Peruv.* 4. ined. t. 510.

Hab. in Peruviæ nemoribus. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)

Frutex 5-6-pedalis. *Flores* purpurei.

2. *A. muricata*, foliis amplis ellipticis crenatis brevè acuminatis 3-nerviis basi subcordatis suprà nudis subtùs ramulisque densè granulosis, calycibus muricatis.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Folia pedalia, 5-pollicaris lata. *Panicula* terminalis, multiflora, granuloso-muricata.

3. *A. lanceolata*, foliis ellipticis acuminatis dentatis 5-nerviis suprà planis glabris subtùs fusco-tomentosis, racemis paniculatis terminalibus lateralibusque.

Axinæa lanceolata, *R. P. Syst. Veg. Fl. Per. et Chil.* 1. p. 122.

Ibid. *Fl. Peruv.* 4. ined. t. 509.

Hab. in Peruviæ sylvis, ad Muna et Pinao. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)

Arbor magna, frondosa. *Flores* albi.

4. *A. glandulosa*, foliis ovatis 5-nerviis denticulatis subtùs flavescenti-tomentosis suprà planis glabris basi biglandulosis, paniculâ terminali multiflorâ.

Axinæa glandulosa, *R. P. Fl. Peruv.* 4. ined. t. 512.

Hab. in Peruviâ. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)

Arbor frondosa. *Flores* albi.

5. *A. dependens*, foliis lanceolatis acuminatis dentato-serratis 5-nerviis suprà glabris, racemo terminali paniculato pendulo.

Axinæa dependens, *R. P. Fl. Peruv.* 4. ined. t. 511.

Hab. in Peruviâ. *Ruiz et Pavon.* ♄.

Meriania, *Swartz, Fl. Ind. Occid.*

Wrightia, *Soland. MSS.*
Melastomæ sp. *Swartz Prod.*

Calyx campanulatus, coriaceus, glaber, basi nudus: *limbo* urceolato, persistente, 5 rariùs 6-dentato: *dentibus* longis, lineari-subulatis, persistentibus, intùs membranâ latâ rotundatâ persistente auctis. *Petala* 5 rariùs 6, latè obovata, fauci annulari latiusculæ inserta. *Stamina* 10 rariùs 12, eidem margini intra petala inserta: *filamenta* erecta, compresso-plana, dilatata: *antheræ* oblongæ, subcompressæ, declinatæ, basi processu calcarato nunc bifido instructæ, apice poro gemino hiantes, infrà dorso filamentis adnatæ. *Ovarium* liberum. *Stylus* teres, curvatus, crassus. *Stigma* simplicissimum obtusum. *Capsula* globosa, calyce crasso coriaceo vestita at libera, 5-locularis 5-valvis, nunc 6-locularis 6-valvis: *valvis* rimâ oblongâ in medio cujusque lòculi hiantibus. *Dissepimenta* membranacea in medio valvarum inserta, axi centrali adnata. *Placentæ* 5, oblongæ, subtrigonæ, lunatæ, rugosæ, scrobiculatæ in loculis centrales, seminibus creberrimè tectæ. *Semina* ovata, majuscula, fusca, umbilico magno laterali convexo nigro aucta: *testa* duplex; exterior crassa, coriaceo-crustacea; interior membranacea. *Embryo* luteus, rectus, ovoideus cavitati seminis conformis: *cotyl.* crassæ, hemisphæricæ, æquales: *radicula* cylindracea, obtusa, cotyledonibus longior, recta.

Arbores *superbæ* (*Jamaicenses*), *frondosæ, nitidissimæ.* Folia *oblonga* v. *lanceolata, acuta, trinervia, coriacea, crenulata, petiolata, opposita, utrinque glabra, nitida, basi rotundata.* Pedunculi *axillares, oppositi, uniflori, glabri, apice bibracteati.* Flores *magni, speciosi, albi aut purpurei.*

Obs. Distinctissimi hujus generis præter novas quas infrà descripsi duæ sunt species, scilicet, *Meriania leucantha* Sw., et *Meriania purpurea* Sw., quæ *Wrightia superba* Soland. In anno 1777 nomen Wrightiæ imposuit celeberr. Solander, teste Wrightio ipso; tamen alia Wrightia inter Apocineas extat, ab illust. Brown in memoriam viri clarissimi dicata.

M. prunifolia, foliis ovatis serrulatis, floribus subsessilibus.
Osbeckia axillaris, *Pavon MSS.*
Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)
Frutex ramosissimus, frondosus. *Flores* axillares, brevissimè pedunculati, bibracteati, purpurei, magni.

M. parviflora, foliis ellipticis acutis denticulatis, pedunculis trifidis trifloris.
Hab. in Braziliâ. *Sello.* (v. s. in Herb. Sims.)
Frutex erectus, ramosus, glaber. *Folia* ultrà pollicaria. *Flores* parvi, rosei.

Blakea, *Browne, Linn.*

Topobœa, *Aubl.*
Valdesia, *Ruiz et Pavon.*

Calyx campanulatus, squamis 4 v. 6, subrotundis, latis coriaceis cruciatim v. triplici ordine dispositis cinctus, in æstivatione extùs fusco-tomentosus: *limbo* urceolato, leviter 6-lobo v. 6 raró 8-denticulato, persistente. *Petala* 6 raró 8, elliptica, coriacea, sessilia v. unguiculata lateribus inæqualibus, basi sæpiùs obliqua, in orem calycis circumambienti margini latiusculo inserta. *Stamina* 12, nunc 16, æqualia, eidem margini inserta: *filamenta* brevia, compresso-plana: *antheræ* in cylindrum v. annulum subcoalitæ, mag-

næ, suborbiculatæ, compressæ v. oblongæ, trigonæ, basi in calcare brevissimo emarginato productæ, ad basin lateris interni filamentis adnatæ, apice obtusæ (rarissimè subacutæ) poris geminis hiantes. *Stylus* robustus, rectus, supernè angustatus, parùm curvatus. *Stigma* obtusum, simplex, pruinosum. *Capsula* baccata, sphærica, calyce crasso coriaceo obvoluta, et cum eo connata, 6-locularis, 6-valvis, interdùm 8-locularis, 8-valvis: *valvis* crassis, coriaceis, rimâ oblongâ singulis in medio loculi hiantibus. *Dissepimenta* coriacea, medio valvarum inserta, axi centrali firmè adnatæ. *Placentæ* 6, crassæ, carnosæ, trigonæ, scrobiculatæ, simul cum parietibus capsulæ imbricatè seminiferæ, axi centrali longitudinalitèr affixæ. *Semina* ovata, majuscula, fusca, punctata, umbilico oblongo laterali, convexo, nigrescente aucta: *testa* duplex; exterior crassa, coriaceo-crustacea; interior membranacea: *albumen* nullum. *Embryo* luteus, rectus, ovoideus, cavitati seminis conformis: *cotyl.* crassæ, hemisphæricæ, æquales: *radicula* cylindracea, crassa, obtusa, cotyledonibus longior, recta.

Arbusculæ *aut* frutices (*Amer. Æquin. et Ind. Occid.*), *ramis teretibus* v. *tetragonis sæpiùs tomentosis.* Folia *opposita, petiolata, 3-5-nervia, coriacea, integerrima* v. *crenulata, suprà glabra, nitida, subtùs sæpiùs densè ferrugineo-tomentosa.* Pedunculi *axillares teretes, uniflori, nudi, oppositi* v. *solitarii, foliis breviores, sæpiùs fusco-tomentosi.* Flores *magni, speciosi rosei.*

Obs. Ad hoc genus referendæ præter species omnes infrà descriptas fortè *Melastoma Cacatin* Aubl.

§ *Calycibus limbo 6-lobis, squamis 4 rarò 6 basi cinctis.*

1. *B. trinervis*, foliis ovali-oblongis trinerviis; adultis utrinque glabris nitidis, petiolis ramulisque rufo-

tomentosis, pedunculis solitariis petiolo longioribus, squamis calyce longioribus triplici ordine dispositis.

Blakea trinervia, *Linn.*

Hab. in Insulâ Jamaicâ. *Browne, Wright.* ♄. (v. v. c. et s. spont.)

2. *B. Mexicana*, foliis ellipticis acutis 5-nerviis denticulatis subtùs pilosis, pedunculis subternis, squamis calyce longioribus.

Hab. in Mexico. *Pavon.* ♄. (v. s. in Herb. Lamb.)

3. *B. rosea*, foliis ovali-lanceolatis acuminatis glabris, pedunculis geminis, squamis calyce longioribus, petalis mucronatis.

Valdesia rosea, *Fl. Peruv.* v. 4. ined. t. 408.

Hab. in Peruviâ. *Ruiz et Pavon.* ♄.

Arbor erecta.

4. *B. ovalis*, foliis ovalibus acuminatis utrinque nudis nitidisque 3-nerviis, pedunculis geminis, squamis calyce longioribus, petalis obtusis.

Valdesia ovalis, *Ruiz et Pavon Syst. Veg. Fl. Peruv.* p. 121.

Ibid. *Fl. Peruv.* v. 4. ined. t. 406.

Hab. in Peruviâ. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)

Arbor erecta, 8-orgyalis.

5. *B. repens*, foliis lanceolatis acuminatis 3-nerviis subtùs pilosis, pedunculis geminis, squamis calyce brevioribus, petalis mucronulatis.

Valdesia repens, *Ruiz et Pavon Syst. Veg. Fl. Peruv.* p. 121, et *Fl. Peruv.* v. 4. ined. t. 405.

Hab. in Peruviâ. *Ruiz et Pavon.* ♄. (v. s. in Herb. Lamb.)

6. *B. latifolia*, foliis amplis ovalibus triplinerviis acumi-

natis glabris, pedunculis solitariis, squamis calyce longioribus.

Valdesia latifolia, *Fl. Peruv.* v. 4. ined. t. 407.

Hab. in Peruviâ. *Ruiz et Pavon.* ♄.

Arbor erecta.

§ *Calycibus limbo 6-denticulatis, squamis quatuor cinctis.*

7. *B. quinquenervis*, foliis ellipticis acuminatis 5-nerviis utrinque nudis nitidisque, pedunculis geminis petiolo brevioribus, squamis calyce longioribus.

Blakea quinquenervia, *Aubl. Guj.* 1. p. 525, t. 210, *Lam. Encycl.* 4. p. 61.

Blakea triplinervia, *Linn. Suppl.* p. 246, *Vahl. Symb.* 3. p. 61, *Willd. Sp. Pl.* 2. p. 845.

Hab. in Guianæ sylvis. *Aublet.* ♄.

Arbor 16-pedalis. *Folia* spithamea. *Pedunculi* sæpe gemini. *Flores* magni, speciosi, carnei, disco albi. *Bacca* subrotunda, magnitudine fructus *Mespili Germanicæ.*

8. *B. multiflora*, foliis ovali-oblongis brevè acuminatis 5-nerviis subtùs pilosis, pedunculis subternis, squamis calyce triplò brevioribus.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Arbor..........

9. *B. rotundifolia*, foliis amplis subrotundis 5-nerviis subtus ramulisque densè ferrugineo-tomentosis, pedunculis solitariis, squamis calyce longioribus.

Hab. in Peruviâ. *Pavon.* ♄. (v. s. in Herb. Lamb.)

Foliorum pagina, 6-7-pollicaris, latitudine 4-6-unciali.

10. *B. macrophylla*, foliis amplis ovalibus 5-nerviis utrinque nudis, pedunculis solitariis, squamis calyce longioribus.

Hab. in Mexico. *Pavon.* ♄. (v. s. in Herb. Lamb.)
Folia pedalia, latitudine 7-pollicaria.

11. *B. parasitica*, foliis subrotundo-cordatis 5-nerviis mucronatis supra glabris nitidisque, pedunculis brevibus subternis, squamis calycem æquantibus.
Topobœa parasitica, *Aubl. Guj.* p. 476. t. 189.
Hab. in Guianâ. *Aublet, Martin.* ♄. (v. s. in Herb. Lamb.)
Frutex supra truncos arborum scandens et radicans.

12. *B. lævigata*, foliis ovalibus integerrimis trinerviis ramulisque glabris, pedunculis solitariis petiolo brevioribus, squamis basi connatis calyce brevioribus.
Blakea trinervis, *Pavon MSS.*
Hab. in Mexico. *Pavon.* ♄.

CHARIANTHUS.

MELASTOMÆ sp. *Auctor.*

Calyx tubuloso-campanulatus, pube stellatâ lepidotus, fauci urceolatus: *limbo* patente 4-lobo, coriaceo, persistente: *lobis* rotundatis. *Petala* 4, erecta, ovalia, obtusa, incumbenti-tubulosa, sessilia, concava, subcoriacea, fauci annulari incrassatæ inserta, lateribus obliqua. *Stamina* 8, erecta, subæqualia, fauci inserta: *filamenta* longissima, angustè linearia, compressa, glabra: *antheræ* filamenti continuæ, oblongæ, clavæformes, erectæ, persistentes! introrsùm biloculares, duplici rimâ longitudinali dehiscentes! basi omninò nudâ in filamentis continuâ. *Ovarium* cum calyce arctè connatum. *Stylus* staminibus longior, rectus, cylindricus, glaber, supernè curvatus. *Stigma* simplex, obtusum, pruinosum. *Capsula* baccata, globosa, glabra, calyce

inclusa et arctè cum eo connata, summo levitèr umbilicata, 4-locularis, 4-valvis, ab apice quadrifariam dehiscens limbo calycino coronata: *valvis* coriaceis. *Placentæ* 4, lunatæ, trigonæ, carnosæ, valdè scrobiculatæ simul cum parietibus capsulæ crebrè seminiferæ. *Semina* numerosa, minuta, ovata, fusca, umbilico magno oblongo laterali nigrescente notata: *testa* duplex; exterior crassiuscula, coriaceo-crustacea; interior tenuissima, membranacea: *albumen* nullum. *Embryo* rectus, albus, cavitati seminis conformis: *cotyl.* breves, crassæ, hemisphæricæ: *radicula* teres, crassa, cotyledonibus duplò longior, infera, basi attenuata.

Frutices v. arbusculæ (*Ind. Occid.*) *erectæ, ramosæ.* Folia *opposita, 5-nervia, integerrima, petiolata.* Flores *terminales, numerosi, corymboso-paniculati, magni, purpurei* v. *sanguinei.* Baccæ *atro-purpureæ, edules.*

Obs. Hocce novum et pulcherrimum genus interea ad calcem ordinis adjeci, dum mihi est sententia quòd illum meliùs inter Myrtaceas ordinandum, et præsertim si quidem dehiscentia antherarum magni valoris characterem habenda est quòd ipse judico; verò si in adversâ sententiâ veniunt Botanici, et hocce signum differentiale minimè valere æstimant, verè limites horum ordinum nec facile erint definiendi, quia vix ullus erit character sejungere illos. Charianthum dixi a χαριεις, *venustus*, et ανθος, *flos.*

1. *C. coccineus*, foliis ovalibus acuminatis subtùs petiolisque stellato-pubescentibus: basi integerrimâ, ramulis pubescentibus.

Melastoma coccinea, *Act. Soc. Nat. Hist. Paris.* 1. p. 109, *Richard in Bonpl. Monog.* p. 31. t. 16.

Melastoma alpina, *Sw. Fl. Ind. Occid.* 2. p. 800, *Willd. Sp. Pl.* 2. p. 597.

Hab. in Insulæ Guadelupæ Monte la Soufriere dicto

(*du Ponthieu*, *Richard*), in Insulâ St Christophorii (*Tobin*), in Martinica (*Richard*). ♄. (v. s. in Herb. Lamb.)

2. *C. purpureus*, foliis cordato-ovalibus brevè acuminatis 5-nerviis subtùs marginibusque pilosis: basi emarginatâ, petiolis ramulisque hispidè setosis.

   Melastoma coccinea, *Vahl Eclog.* 1. p. 48, *Willd. Sp. Pl.* 2. p. 599.

   Hab. in Insulâ Montserrat (*Ryan*), in Insulâ Nevis (*Tobin*). ♄. (v. s. in Herb. Lamb.)

3. *C. tinifolius*, foliis ovatis coriaceis utrinque ramulisque glabris.

   Hab. in Indiâ Occidentali. *Anderson.* ♄. (v. s. in Herb. Lamb.)

   Flores sanguineo-purpurei. *Folia* coriacea, glabra, nitida, nervis lateralibus obsoletis, præcedentibus quadruplò minora, apice brevissimè obtusèque acuminata.

N. B. At p. 282, after *Memecylon*, read *Linn.* instead of *Du Petit Thouars.*

XXV.—*Examination by Chemical Re-agents of a Liquid from the Crater of Vulcano, one of the Lipari Islands.*

By JOHN MURRAY, F.L.S. M.W.S. &c. &c.

(Read 30th November 1822.)

THIS liquid, the Earl of Mountnorris informs me, is from the bottom of the crater of Vulcano, one of the Lipari Islands, the seat of active fires.

The liquid is quite diaphanous. Its taste is styptic and astringent, and it slightly *reddens* litmus paper.

Diluted with distilled water, it was submitted to chemical re-agents.

Lime-water rendered it milky, and *magnesia* was inferred.

Oxalate of ammonia produced, after a few minutes repose, a slight opacity, indicating the presence of *lime.*

Solutions of *silver* determined the existence of *muriates.*

Nitrate of baryta exhibited a copious precipitate, and thus shewed *sulphates* to be present in the solution.

Phosphate of soda determined an abundant precipitate, corroborating the inference obtained from the phenomena presented by the lime-water.

With chromic acid, chromate of potassa, muriate of tin, muriate of ammonia, and tincture of iodine, no new phænomena were presented; or, at any rate, if a change did occur, it was not appreciable.

Ferro-cyanate of ammonia, and *ferro-cyanate of potassa*, produced a copious *prussian-blue precipitate*, and therefore *iron* was held suspended in the liquid.

With pure *ammonia*, the solution became turbid, and changed to a *brownish-green*.

Hydriodate of potassa yielded a *yellow-green precipitate*.

Ferro-cyanate of potassa gave a *greenish-white precipitate*, with the colourless liquid which remained, after separating the prussian-blue by the filter.

The three last chemical tests appear to determine the existence of *nickel* in this liquid.

With much diluted *tincture of galls*, a *reddish tint* was primarily obtained; it became subsequently darker, and finally attenuated into a lighter shade.

Hydro-sulphuret of ammonia formed an immediate *copious green precipitate*, clouded with cobweb-like films.

The phænomena presented by the agencies of the tincture of galls, and hydro-sulphuret of ammonia, are such as would be exhibited by *titanium*, and, therefore, this metal may also be concluded upon.

Pure potassa was mixed with the liquid *undiluted*, in a watch-glass, and a feather moistened with muriatic acid brought near; the *white* vapours produced, determined the evolution of ammoniacal gas: the *odour* of ammonia was also unequivocal.

Nitro-muriate of platinum dropt into the undiluted liquid, in a small capsule, and allowed to evaporate spon-

taneously, yielded arenaceous crystals, of a yellowish-red tint: examined by the lens, these were found to be chiefly octahedral; some seemed to be duodecahedral. Stars formed of groups of transparent and diaphanic acicular crystals also pervaded the liquid mass—(Muriate of potassa?)

This volcanic liquid is unusually interesting from its containing *iron* associated with *nickel* and *titanium*, and particularly remarkable for holding in solution the constituents of *meteoric stones*, with the solitary exception of *silica*. This liquid must have been ejected in the form of vapour, and subsequently condensed. The fact clearly proves the susceptibility of iron, thus combined with nickel, &c. being held suspended in the atmosphere. In reference to silica, we have Dr MACCULLOCH's authority for assuming that it may be sublimed; and in the thermal waters of Lucca, Bath, &c. it is intimately combined with oxide of iron, where it seems to act the part of an acid.

Before that I can believe *aërolites* to be the exotic growth of an extra atmospheric locality, I must possess more ample evidence than has yet been adduced.

Among a variety of interesting minerals from the Lipari Islands which the Earl of Mountnorris presented to me, *two* merit particular notice; and both of them, his Lordship told me, were from the crater of Vulcano. One formed part of a stalactitic mass of *Alum*,—and the other, Lord Mountnorris assured me, had been pronounced to be *Baryta*.

By reducing a portion of this volcanic alum to powder, and triturating it with a saturated solution of pure caustic potassa, *ammoniacal gas* was copiously evolved, and decided by its *odour*,—*white* fumes, with muriatic acid, and *violet* tint, with cupreous solutions. The alum was somewhat granular and spongy, and on its solution in distilled

water did not develope the octohedral form, but evolved air-bells. Nitro-muriate of platinum did not affect a saturated solution of this alum. Its composition, therefore, is an *ammoniaco-sulphate of alumina.*

The Baryta was not at any rate *terra ponderosa*, for it was exceedingly *light* and tender; the minute foliæ which composed the mass were of a pearly semblance, and felt somewhat unctuous to touch. The scales had every appearance of *boracic acid;* dissolved in distilled water, it *reddened* litmus paper; and, with alcohol, exhibited, when inflamed, the *green* colour which characterizes boracic acid.

That the waters of the ocean have some subterranean communication with the source of volcanic fires, has ever appeared to me a conclusion perfectly warrantable; but the spring whence the *muriate of ammonia* has flowed, is a problem of more difficult complexion. I greatly deceive myself, however, if an ammoniacal combination does not obtain in *marine salt.* If sea-salt be finely powdered and triturated with a solution of caustic potassa, or even with dry quicklime, muriatic acid will announce the escape of *ammonia.*

This circumstance, combined with the researches of ROUELLE and PROUST, respecting the existence of a mercurial salt in the oceanic waters, would lead us to conclude, when conjoined with the discovery of muriate of potassa in them by Dr WOLLASTON, that their chemical constituents are more *complex* than had been hitherto supposed.

XXVI.—*Notice of Marine Deposites on the Margin of Loch Lomond.*

By Mr J. Adamson.

(*Read* 14*th December* 1822.)

As to beauty or magnificence of scenery, Loch Lomond has many interesting features common to it with the other Scottish lakes which occupy the chasms of the great primitive mountainous district; it is, however, more closely connected with a different set of hollows. It is the most characteristic example of a group of long recesses which lie together, and nearly parallel to each other, but which, instead of following the direction of the mountain ranges, stretch almost perpendicular to it, generally cutting through the Transition and part of the Primitive rocks, together with the older members of the Flœtz formation. All the others of those valleys are connected with the sea by means of the Frith of Clyde, and are partly filled with its salt water, and enlivened by its appropriate animals. There is reason enough to believe, that this was at one time the condition of Loch Lomond also; but at present, we find there, along with the Ocean's depth, only the remains of its inhabitants.

One of these marine deposites was about eight or ten feet above the highest level of the present waters. It lay in a small hollow, under a projecting precipice of limestone, close to the margin of the lake. The only remains of it now are some fragments of a very compact calc-tuff, containing sea-shells disseminated through it. The limestone-rock is now quarried; and the calc-tuff being the most accessible and richest limestone, was first carried off for use. The shells appear to have been accumulated in a situation exposed to the stalactite droppings from the lime-rock. In the interior of the tuffa, they are chiefly the Mytilus edulis, or its congeners; but the surface is sprinkled with imbedded specimens, belonging to the genera Planorbis and Helix, which have accidentally fallen upon it. This quarry is on the east side of the lake, about two miles north-west from the mouth of the Endrick, and on the north side of the great range of islands composed of Secondary Conglomerate, which stretches across the southern end of the lake. This limestone is on the lands of his Grace the Duke of Montrose, and is worked for his tenantry, but is not much esteemed for agricultural purposes. It is highly crystalline in its fracture, appearing to be irregular layers of crystals, separated by quartz and clay.

There are other two places, which afford shells, in very different circumstances. Those points are similar in situation; both are in slight bays opening to the north, and presenting a steep gravelly beach to the water. One of them is on the island Inch Lonach, opposite to the village of Luss; and the other, on the lands of H. Macdonald Buchanan, Esq., near the south-east angle of the lake. The shells begin to appear about half-way between the highest and lowest, or the winter and summer, surfaces of the water, which varies in this respect about six feet. After removing a slight covering of coarse gravel, we find a thin

bed of clay, of different shades of brown, passing into yellow colours, as we descend. In the upper, or brown clay, are found shells of the following species. Those marked ? are doubtful.

Buccinum reticulatum?
Nerita glaucina.
Tellina tenuis?
Cardium edule.
Venus striatula.
Venus Islandica.
Nucula rostrata, young.
Pecten obsoletus.
Anomia ephippium, young.
Balanus communis.
Balanus rugosus.
Echinus esculentus.

A skilful conchologist would discover many others, from the numerous traces of them in the clay. Those shells appear to have been deposited generally in an entire state, and many are found with both valves in their natural position. The Balanus is still slightly attached to the Venus or Pecten; and the spines of the Echinus are found clustered in the clay inclosing its fragments; so that they must have been either covered by water to a considerable depth, or thrown on a beach not much exposed to waves. Few of them, however, can be extracted entire, as several of the species are always in a state of gritty chalk; but many complete and beautiful specimens of the pecten can easily be procured. Few of their fragments appear on the exposed part of the beach, but, during summer, many may be seen a few feet under water. Those deposites cannot be more than about twenty-two feet above the present level of the sea. It is probable that an attentive inspection of the margin of the lake would discover many others similar to them.

A little attention may be necessary, to an opinion, which we sometimes hear expressed in conversation, "that such hollows, as Loch Lomond, with a bottom so far below the level of the ocean, ought, if ever they were filled by it, still to retain its salt water." It seems to be imagined, that the sea-water, on account of its greater specific gravity, is still retained in the deep pits of these chasms, and that the fresh-water glides unmixed above it, or changes by evaporation and renewal, without affecting its deeply buried mass. It does not seem difficult to demonstrate the improbability of this supposition. For the phenomena of solution can be accounted for only on some hypothesis such as this: that, when a film of pure water is applied to a film containing salt in solution, there is a tendency in them to unite, and form a compound of less saturation than the latter; which compound has a corresponding influence on the nearest, or on any number of saturated films beneath it; and will, in like manner, be affected and changed by the next pure film above it, and, successively, by any number of films in any depth of water. The changes will cease only when an equilibrium of attractions has taken place through the whole mass, which will then be in a state of medium and uniform saturation. Whatever be the time required for the combination of two films, that time would be an element in the equation, representing the whole period necessary to produce uniformity, which must therefore depend on the number of films, or be a function of the depth. Changes of temperature at the surface would very much accelerate the result, by sending downwards dense films, having the highest degree of attraction, until stopt among others, having the same specific gravity, arising from greater saturation; so that probably no long time would elapse before nearly uniform saturation took place, even though the combined depth of the fluids were considerable. But the tendency

towards uniform saturation is opposed in a manner which must quickly draw off the salt-water from a hollow, such as a lake; because the surface-water, in general, is continually changing, and the water, which has become slightly saturated, flows off, and is replaced by that which is purer, and has a greater attraction for the salt; and to satisfy this augmented attraction, the progress of change downwards must be much more rapid. Consequently, however slowly the tendency to equilibrium may act in an isolated solution,—in the other case, as the progress of exhaustion goes on more rapidly, we may expect that no long period would be required to destroy all perceptible saltness. That this period has long since passed, in our Scottish lakes, can scarcely be doubted; but though we be not able to bring up sea-water from the bottom of any of them, yet all are interesting objects of observation. Loch Lomond in particular, as the additions it receives are so uniformly distributed over the whole space of its margin, is admirably fitted for experiments on the changes or stability of temperature in deep waters.

XXVII.—*Descriptions of the Esculent Fungi of Great Britain, with Observations.*

By Robert Kaye Greville, Esq. F.R.S.E. M.W.S. &c.

(*Read 28th December* 1822.)

Great Britain is the only country in Europe in which, with the exception of two or three species, the *Fungi* are looked down upon with contempt and aversion; nor have its inhabitants profited of late, by the knowledge, that they possess most of those species which supply a constant resource to thousands of their continental neighbours.

If we go back to the earliest European writers on Natural History, we find mention invariably made of a number of kinds employed as food in France, Italy, and Germany. The old descriptions of Fungi are indeed unintelligible, and they are frequently merely enumerated as *Fungus esculentus primus, secundus*, &c.; but the number thus given, shews them to have been extensively used, and, we have reason to conclude, long before authors arose to notice them. At present, they form a regular article of diet throughout the greater part of Europe, and not merely

as a resource in times of scarcity, but as a delicacy. It is therefore not a little extraordinary, that *we*, who have before our eyes several esteemed species in the utmost profusion, should neglect the whole, except the common Mushroom, the Truffle, and the Morelle. On the Continent, it is a common practice to eat various fungi in a raw state, which, it is said, renders them more nutritious. SCHWÆGRICHEN mentions this expressly, in an extract of a letter quoted by PERSOON.—"In travelling through Germany and Austria, I observed the peasants in the vicinity of Nuremberg, where I lived a part of the summer, to eat raw mushrooms seasoned with anise-seed and carroway-seed, along with their black bread. Being then employed on the study of cryptogamous plants, I resolved to try the effect of this kind of food on my own person.

"I therefore imitated these people, and succeeded so completely, that, during several weeks, I ate nothing but bread and raw fungi, and drank nothing but water. Instead of finding my health affected, I rather experienced an increase of strength. I preferred those species which had neither a bad flavour nor a disagreeable smell, and which had a tolerably firm consistence; as, *Boletus esculentus*, *B. rufus*, *Agaricus campestris*, *Ag. procerus*, *Clavaria coralloides*, &c.

"I have observed that fungi, if moderately used, are very nourishing, but that they lose their good qualities by culinary preparation, which deprives them of their natural taste."—PERSOON *Traité sur les Champignons comestibles*, p. 157.

Of all people I am acquainted with, the Russians seem to employ them most exclusively as aliment; and on this subject, Professor PALLAS, in his *Voyage dans plusieurs Provinces de l'Empire de la Russie*, vol. i. p. 65, has given us a few interesting details, which are so much to the pur-

pose, that they are worth transcribing.—"*Le temps doux et humide avoit fait croître dans les bois un grand nombre de champignons de toutes sortes d'espèces. Les gens de la campagne en mangent beaucoup, et en font de fortes provisions pour l'hiver. Ces champignons et le pain sont à peu près pendant le carême, la seule nourriture des pauvres paysans des contrées forestières. Ils font sécher ou ils salent ceux qu'ils veulent conserver pour l'hiver. On mange généralement en Russie toutes les espèces de champignons, et même ceux qui sont ou passés ou verreux. Le champignon de mouche* (Amanita muscaria); *le champignon puant du fumier, et plusieurs autres petits, entièrement denués de chair, sont les seuls dont on ne fait point usage. Les premiers n'ont encore causé aucuns malheurs. Les paysans se contentent de les faire bouillir dans l'eau, avec un peu de sel. Le peuple connoît parfaitement toutes ces espèces-ci; chacune a sa denomination particuliere. Il en mange plusieurs espèces** *que l'on regarde ailleurs comme très-pernicieuses, telles que l'Agaric des champs*, (Agaricus campestris, GRIB, *Russ.*), *l'Agaric pur*, (Agaricus integer, VOLONI, *Russ.*), *l'Agaric de Georgie* (Ag. Georgii, GROUZD, *Russ.*), *l'Agaric délicieux* (Ag. deliciosus, RIJIK, *Russ.*), *l'Agaric à canelle* (Ag. cinnamomeus, VOLJANKA, *Russ.*), *l'Agaric destructeur* (Ag. extinctorius, SKRIPITZA, *Russ.*), *et l'Agaric fragile* (Ag. fragilis, OPIONKA, *Russ.*) *On fait secher ces espèces. On se sert encore de la Truffe visqueuse* (Boletus viscidus, MASLENIK, *Russ.*), *de l'Agaric jaune* (Boletus luteus, BERESOVIK, *Russ.*), *de la Truffe de bœuf* (Boletus bovinus, BOROVIK et KOROVIK, *Russ.*), *et du Champignon de couches à réseaux* (Morchella esculenta, SINORCHOK, *Russ.*)"

The Russians employ in dyeing, those *Boleti* which change immediately to a blue colour on being cut.

All the eatable fungi are contained in the genera *Tuber*, *Morchella*, *Helvella*, *Clavaria*, *Hydnum*, *Cantharellus*, *Boletus*, *Agaricus*, and *Amanita*; species of all of which we possess in this country.

As a guide in the selection of unknown fungi, colour is probably of considerable importance. "*Quamobrem recte scribit Avicenna*," says MATHIOLUS, "*eos nocentiores esse, qui nigri vel virides, vel in nigro purpurascentes visuntur*." PERSOON remarks, that a pure yellow or golden colour, especially in the lamellæ of Agarics, denotes a good quality. Many excellent species have a very pale or nearly white pileus; some are brown. A vinous red and violet is said to be universally wholesome; but orange-red and rose-colour, poisonous. In regard to the *Boleti* more especially, all are edible according to DE CANDOLLE, *Essai*, p. 328, except, 1*st*, coriaceous and ligneous species; 2*d*, those whose stem is furnished with a collar or annular veil; 3*d*, those with an acrid taste; and, 4*th*, those whose flesh turns to a blue colour on being cut. Wherever this last character is perceived in any plant of the order, it always denotes a poisonous property.

An excellent rule, and perhaps the best, in selecting or in making experiments upon unknown mushrooms, is to taste them. If they are *astringent*, *styptic*, or leave a disagreeable sensation on the tongue (the *arrière-goût* of PERSOON), reject them. Those also that have a pungent or unpleasant smell, should be equally neglected.

Agarics growing in tufts and clusters from the trunks or stumps of trees are almost universally to be avoided.

Fungi, especially *Agarici* and *Boleti*, should be gathered for the table before they arrive at their full age, as they frequently then become tough and insipid. The hymenium, or that part containing the fructification, should, when it consists of tubes (as in the *Boleti*), be invariably

removed, as it is often noxious, when the rest of the plant is unexceptionable. When the hymenium consists of gills or lamellæ (as in *Agaricus* and *Amanita*), they need not be separated if the plant be taken quite young; but if the pileus or cap be expanded, they must be removed before cooking.

As the plant commonly known by the name of the *fly-fungus* (from its property of destroying flies when steeped in milk), has made some noise of late on the Continent, I must warn those who might feel inclined to try it in this country, of the danger they would expose themselves to. It has not been clearly ascertained whether the species which grows in this country, and in the south of Europe, be indeed the same as that which is found in Kamtschatka, and called *Amanita Muscaria Kamtschatica*. At any rate, our plant is known to be highly poisonous; and the Kamtschatka variety may be another species, or have partly lost its virulence, from inhabiting a more northern climate. The properties of this variety are exceedingly curious, and as they are contained in a German essay by Dr Langsdorf, in *Annalen der Wetterauischen Gesellschaft für die gesamente Naturkunde*, I trust a concise account of them will not be unacceptable.

This variety of *Amanita Muscaria* is used by the inhabitants of the north-eastern parts of Asia, in the same manner as wine, brandy, arrack, opium, &c. is by other nations.

These fungi are found most plentifully about Wischna Kamtschatka, and Milkowa Derewna, and are very abundant in some seasons, and scarce in others. They are collected in the hottest months, and hung up by a string in the air to dry: some dry of themselves on the ground, and are said to be far more narcotic than those artificially preserved. Small deep-coloured specimens thickly covered

with warts, are also said to be more powerful than those of a larger size and paler colour.

The usual mode of taking the fungus is, to roll it up like a bolus, and swallow it without chewing, which, the Kamtschadales say, would disorder the stomach. It is sometimes eaten fresh in soups and sauces, and then loses much of its intoxicating property; when steeped in the juice of the berries of *Vaccinium uliginosum*, its effects are those of strong wine.

One large, or two small fungi, is a common dose to produce a pleasant intoxication for a whole day, particularly if water be drunk after it, which augments the narcotic principle.

The desired effect comes on from one to two hours after taking the fungus. Giddiness and drunkenness result from the fungus, in the same manner as from wine or spirits; cheerful emotions of the mind are first produced; the countenance becomes flushed; involuntary words and actions follow, and sometimes at last an entire loss of consciousness. It renders some remarkably active, and proves highly stimulant to muscular exertion: with too large a dose, violent spasmodic effects are produced.

So very exciting to the nervous system, in many individuals, is this fungus, that the effects are often very ludicrous. If a person under its influence wishes to step over a straw or small stick, he takes a stride or a jump sufficient to clear the trunk of a tree; a talkative person cannot keep silence or secrets; and one fond of music is perpetually singing.

The most singular effect of the *Amanita* is the influence it possesses over the urine. It is said that, from time immemorial, the inhabitants have known that the fungus imparts an intoxicating quality to that secretion, which continues for a considerable time after taking it. For instance;

a man moderately intoxicated to-day, will by the next morning have slept himself sober; but (as is the custom) by taking a tea-cup of his urine, be more powerfully intoxicated than he was the preceding day by the fungus. It is therefore not uncommon for confirmed drunkards to preserve their urine as a precious liquor, against a scarcity of the fungus. This intoxicating property of the urine is capable of being propagated; for every one who partakes of it has his urine similarly affected. Thus, with a very few *Amanitæ*, a party of drunkards may keep up their debauch for a week. Dr LANGSDORF mentions, that by means of the second person taking the urine of the first, the third that of the second, and so on, the intoxication may be propagated through five individuals.

NAT. ORD. GASTROMYCI, *Link.*, *Grev.*

(FUNGI sarcocarpi, *Pers.*)

TUBER.

1. *T. cibarium*, subrotundum, nigrescens, valde verrucosum.

T. cibarium, *Bull. Champ.* p. 74, t. 356.—*Sibth. Fl. Oxon.* p. 398.—*Pers. Syn. Fung.* p. 126.—*With. Bot. Arr.* ed. 6. v. 4. p. 422.—*Sow. Fung.* t. 309.—*De Cand. Fl. Franç.* v. 2. p. 278. *Ejusd. Syn.* p. 58.—*Propriet. Med. des Plantes*, p. 322.—*Pers. Champ. comest.* p. 262.—*Hook. Fl. Scot.* pt. 2. p. 10.—*Gray's Nat. Arr.* v. 1. p. 592.

TUBER gulosorum, *Wigg Fl. Holsat.* p. 109.

Tuber brumale, *Mich.* p. 221. t. 102.
Lycoperdon tuber, *Linn. Sp. Pl.* 1653.—*Lightf. Fl. Scot.* v. 2. p. 1064.
Lycoperdon gulosorum, *Scop. Fl. Carn.* v. 2. p. 421.
Truffles.

Hab. A few inches beneath the surface of the soil, especially where of a light sandy or gravelly nature. Autumn.
Desc. Gregarious, roundish, but sometimes irregular, covered with subpyramidal warts, pale, at length nearly quite black. Within firm, solid, yellowish or pale-whitish-brown, and marbled with flexuose lines.

No fungus is more esteemed for the table than the truffle, and, in order to procure a constant supply, dogs, and even pigs, are employed to detect it. Few likewise have been longer noticed; Galen, Avicenna, Pliny, Mathiolus, and many others, having mentioned it, in various terms of approbation. Parkinson, along with a rude figure, gives us the following account: "There is yet another kinde of mushrome (for so it may most fitly be termed, and not rootes, as some would make them to be) that groweth not out or above the ground, as all the former sorts doe, but within or under the upper crust thereof, called in Greeke either ὕδνον and ὕδνα, *ab imbribus*, or οἴδνα, *ab humore*; in Latine, *tuber* and *tubera*; in the Arabian tongue, *rameck alchameck*, *tumer* and *kema*; in Italian, *tartuffi* and *tartufole*; in Spanish, *turmas de tierra*; in French, *truffes* and *truffles*; in Germane, *hirtz brunst*; in English some call them *Spanish fusse-balls*, because they are somewhat like our fusse-balls, which are not edible, but containe a smoaky dust or pouther in them: but I would rather call them *Underground Mushrooms*, or *Spanish trubbes*, to distin-

guish them." GALEN affirms them to have no peculiar property; but AVICENNA says, they are pre-eminent in breeding "grosse and melancholicke humours;" that they "trouble the stomacke, whether they be rosted under the embers or otherwise boiled in broth, and eaten with pepper, oyle, and vinegar." *Vid. Park. Theat. Bot.* p. 1320.

DE CANDOLLE, in his *Essai sur les Propriétés Médicales des Plantes*, remarks, that all the species are wholesome and agreeable to the palate; *Tuber moschatum* and *T. album* being often substituted for the common species, and known to the Piédmontais by the names of *Bianchetti* and *Rossetti*. PERSOON in his *Traité* corroborates this, and adds several additional details.

The modes of cooking truffles are very numerous. They are dressed with champagne; in *potages;* in all kinds of ragouts; in pâtés; in pyes; as stuffing to fowls; and are made even into cream. *Vid.* BULLIARD. By true epicures they are usually only roasted under the embers. In Piédmont, according to BALBIS, they are often eaten raw, as sallad; particularly with snipes, which are scarcely valued unless accompanied with truffles.

Truffles vary much in size; common specimens are about 2—3 inches in diameter; but there are instances mentioned by HALLER, and others, of their weighing even fourteen pounds. As they increase in size, they often raise slightly the ground above them, which frequently cracks, and gives access to a species of fly, of a blue colour, which deposites its eggs in the fungus, and acts as a sort of guide to the truffle-hunter. A figure of this insect is given in the *Lettres de* M. DE BORCH *sur les Truffes du Piédmont.*

The reader will find in BULLIARD, directions for forming a *Truffière.*

2. *T. moschatum*, subrotundum, læve, intus et extus nigrescens.

TUBER moschatum, *Bull. Champ.* p. 79, t. 479.—*Pers. Syn. Fung.* p. 127.—*Sow. Fung.* t. 426.—*De Cand. Fl. Franç.* v. 2. p. 297. *Ejusd. Syn.* p. 58.—*Gray's Nat. Arr.* v. 1. p. 592.

HAB. The same as the preceding, but much rarer.

DESC. Rounded or oblong, smooth, blackish both within and without. It shrinks and becomes corrugated when dry. Smaller than *Tuber cibarium*, from which the smooth surface alone is sufficient to distinguish it.

Perfectly wholesome and edible, but inferior to the preceding. When young, or in a fresh state, smelling strongly of musk.

3. *T. album*, subrugosum ex albido rufescens, vix subterraneum.

T. album, *Bull. Champ.* p. 80. t. 404.—*De Borch Lettres*, p. 6-7.—*Pers. Syn. Fung.* p. 128.—*Sow. Fung.* t. 310. —*With. Bot. Arr.* ed. 6. v. 4. p. 442.—*De Cand. Fl. Franç.* ed. 3. v. 3. p. 279. *Ejusd. Syn.* p. 58.—*Gray's Nat. Arr.* v. 1. p. 592.

LYCOPERDON gibbosum, *Dicks. Pl. Crypt.* fasc. 2. p. 26. *White Truffles.*

HAB. On the ground; very slightly or only partly buried. Autumn.

DESC. Roundish, or irregularly oval, unequal, somewhat rugose, but not warty, solid, firm, whitish, at length changing to a reddish colour, and marked within with reddish lines. Diameter 1-3 inches.

This species possesses similar properties with the two preceding, and is equally wholesome. BULLIARD states that the wild boar is excessively fond of them.

NAT. ORD. FUNGI, *Link*, *Grev.*

(Part of FUNGI, *Juss.* *&c.*)

AMANITA.

4. *A. cæsarca*, pilei margine striato, lamellis luteis, stipite farcto, volva laxa. *Fries.*

AMANITA cæsarea, *Pers. Syn. Fung.* p. 252.

AMANITA aurantiaca, *Pers.* l. c. p. 252.—*Gray's Nat. Arr.* v. 1. p. 599.

AGARICUS cæsareus, *Schæff. Fung.* 253.—*Mich.* t. 77. f. 1.—*All. Fl. Ped.* p. 339.—*Fries Syst. Mycol.* v. 1. p. 15.

AGARICUS aurantiacus, *Bull.* t. 120.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 209.—*Ejusd. Syn.* p. 42.

AGARICUS aureus, *Batsch*, and AG. speciosus, *Gouan* (*fid. Fries.*)

HAB. In fir-woods. Autumn.

DESC. *Pileus* or *cap* hemispherical, becoming less convex in age, orange-red, 4-5 inches broad, striated at the margin, generally smooth, and wholly wartless, often splitting at the edge. *Lamellæ* or *gills* yellow, and rather thick. *Stem* 3-6 inches high, firm, thick, solid. *Veil* annular, persistent. *Plant* furnished with a complete *volva* or wrapper, from which it bursts, leaving the remains at the base of the stem.

This Amanita is liable to be confounded by careless individuals with *Amanita muscaria*, which is poisonous; two simple characters are nevertheless sufficient to banish all uncertainty. In *A. muscaria*, the *volva* or wrapper is not

perfect; in *A. cæsarea*, it envelopes the whole plant when young, and the remains are always to be found at the base of the stem: in *A. muscaria* the gills are *white*, in *A. cæsarea* always *yellow*.

This fungus was well known to the ancients, and highly esteemed by them. The Romans were particularly fond of it; and AGRIPPINA, when she sought to raise her son NERO to the throne, administered poison to her husband CLAUDIUS, by means of this delicacy. It is to this crime that JUVENAL alludes in the following passages:

Vilibus ancipites fungi ponentur amicis,
Boletus domino; sed qualem Claudius edit,
Ante illum uxoris, post quem nihil amplius edit.
Sat. V. 146.

———— Minus ergo nocens erit Agrippinæ
Boletus; si quidem unius præcordia pressit
Ille senis, tremulumque caput descendere jussit
In cœlum, et longam manantia labra salivam.
Sat. VI. 620.

MARTIAL also did not allow so notorious a fact to escape him. Thus,

Quid dignum tanto ventrique gulæque precabor?
Boletum ut, qualem Claudius edit, edas.
Epig. 21. Lib. I.

And in another of his epigrams, Lib. XIII., he shows in a strong light the value placed upon this article of luxury:

Argentum atque aurum facile est
Lanamque togamque
Mittere; Boletos mittere difficile est.

The name by which it was known to the ancients was *Boletus*, and *Fungorum princeps et dominus*. NERO, for whose sake CLAUDIUS had been poisoned, had the impiety to call it the *food of Gods*, because CLAUDIUS was placed among the gods after his death.

It appears that the fungus was afterwards held in less celebrity, from having been the innocent vehicle of poison; an unfortunate kind of logic which PLINY amusingly adopts, and whom I shall quote; preferring, however, to give HOLLAND's translation, rather than the original.

"Among all those things which are eaten with danger, I take that mushromes may be justly ranged in the first and principal place: true it is, that they have a most pleasant and delicate tast; but discredited much they are, and brought into an ill name, by occasion of the poyson which AGRIPPINA the Empresse conveighed unto her husband TIBERIUS CLAUDIUS the Emperour, by their means: a dangerous president given for the like practice afterwards." PLINY adds, that before the pileus has burst from the volva, the volva is as "good meat as the mushrome itselfe." He also observes, that "none are able to discern hurtful mushromes from others, how curious and circumspect soever they be, save only the peasants of the country where they grow." And another source of danger lies, according to the same author, in fungi being very fit objects to retain the poison conveyed by the breath of serpents.

In later times, *A. cæsarea* has recovered its reputation; and, next to *Agaricus campestris*, it is the one most employed. In this country, it probably is comparatively rare; and my only authority for its being really indigenous, is Mr GRAY (who, by the way, gives no stations for his new British plants, and no authority, except his own). In this country, therefore, it has no popular name. In France, it is called *l'orange*, *dorade*, *jaune d'œuf*, *cadran;* in the Pays des Voges, *jazeran* or *jasserans;* in Italy, *coccoli* or *uovali;* and in Piédmont, *bole réal*....*Vid. Pers. Traité*, p. 175.

PERSOON has given the following modes of dressing this fungus, taken partly from Dr PAULET's Work.

In Italy, it is commonly eaten, fried in oil, or sliced with sour vegetable sauce: it is also used to garnish seasoned dishes.

According to M. PAULET, the best manner of cooking it, is, to peel off the skin, and having removed the stem, to dress it with the gills uppermost, filling the cavity with a mixture of herbs, bread-crumbs, garlic, pepper and salt, and sprinkling the whole with olive oil.

The Romans, APICIUS informs us, served it up in wine, or in gravies, and sometimes ate it with honey, oil, and the yolks of eggs. The latter, with wine, Dr PAULET recommends as the best correctives, after having partaken freely of the *orange*.

WITHERING has fallen into a strange error, in supposing that *Agaricus Xerampelinus* or *Ag. deliciosus* was the much-celebrated *Boletus* of the ancients, as neither possesses the least trace of a volva; the latter is certainly still sold in the Italian market, but its identity with the *Fungorum princeps* does not necessarily follow. All the older authors agree in saying, that it resembles an egg in its young state, from which the plant is protruded.

AGARICUS.

5. *Ag. procerus*, elatus, pileo squamoso late umbonato rufescente-cinereo, lamellis albidis, remotis, stipite annulo mobili, bulboso.

AGARICUS procerus, *Scop. Fl. Carn.* v. 2. p. 1465.—*Schæff. Fung.* t. 22. & 23.—*Fl. Dan.* t. 772.—*Huds. Fl. Angl.* v. 2. p. 612.—*With. Bot. Arr.* ed. 6. v. 4. p. 331.—*Fl. Dan.* t. 772.—*Curt. et Hook. Fl. Lond.*

ed. 1. & 2. t. 15.—*Sow. Fung.* t. 190.—*Pers. Syn. Fung.* p. 257.—*Purt. Midl. Fl.* v. 2. p. 648. & v. 3. p. 418.—*Hook. Fl. Scot.* pt. 2. p. 23.—*Fries' Syst. Mycol.* v. 1. p. 20.—*Grev. Fl. Edin. ined.*

AGARICUS colubrinus, *Bull. Champ.* t. 78.

AG. squamosus, *Vill.* p. 1015.

AG. annulatus, *Bolt. Fung.* t. 23.

HAB. In open woods. Autumn. Extremely common.

DESC. *Plant* very elegant, tall, gregarious. *Pileus* 3—7 inches broad, covered with adpressed broad scales, pinkish-brown or greyish, whitish and fibrillose towards the margin, convex, at length nearly plane, umbonate. *Lamellæ* distant, white. *Stem* 4—8 inches high, ½—¾ of an inch thick, white, solid, cylindrical, bulbous at the base, and furnished with a moveable annular white veil.

This Agaric is very generally eaten in France and Italy, and might be rendered a general article of food in this country, where it is exceedingly abundant. The birch and fir woods in the Highlands of Scotland produce it in a profusion scarcely to be credited by those who have not seen it there. Its character is too strongly marked to render mistakes liable; and the numerous provincial appellations it has received on the Continent, is a sufficient proof of its general use and innocent properties. Its French and Italian names, according to DE CANDOLLE and PERSOON, are, *colemelle*, *coulemelle*, *couamalle*, *couleuvrelle*, *couleuvrée*, *cormelle*, *goilmelle*, *quamelle*, *fussée*, *coche*, *cocherel*, *coulsé*, *vertet*, *cluseau*, *eclusiau*, *potiron*, *courtmotte*, *coulmote*, *parasol*, *boutarot*, *poturon*, *pippio*, *mort de froid*, *escargoule*, *penchinado*, *cucamele*; *bubbola maggiore*, *bubbola mozzana*, *mazza di tamburo*, *scarogcs*, *canella*, *escomel*, *copelon*, *pou-*

melle, nez de chat, &c.—*De Cand. Essai,* p. 340. *Pers. Traité,* p. 188.

It is received as an ingredient in most sauces and *fricassées;* and is often broiled with butter, oil, pepper and salt, with a sprinkling of bread-crumbs and fine herbs. The stem being rather tough, is rejected.

In the *Flora Londinensis,* it is mentioned as often exposed to sale in Covent-Garden Market, for the true eatable one; and that, though its spongy flesh renders it less fit for the table than the common mushroom, it is frequently used in making ketchup.

The sponginess of the flesh may be obviated by proper cooking.

6. Ag. *campestris,* pileo carnoso, sicco, subsquamoso sericeove, lamellis liberis, ventricosis, demum fuscis, stipite farcto, annulato albo. *Fries.*

Agaricus campestris, *Linn. Suec.* no. 1203.—*Fl. Dan.* t. 704.—*Schæff. Fung.* t. 33.—*With. Bot. Arr.* ed. 6. v. 4. p. 285.—*Huds. Fl. Angl.* v. 2. p. 610.—*Sow. Fung.* t. 305.—*Bolt. Fung.* t. 45.—*Pers. Syn. Fung.* p. 418.—*Nees' Syst.* t. 24. f. 195.—*Purt. Midl. Fl.* v. 2. p. 638.—*Hook. Fl. Scot.* pt. 2. p. 21.—*Grev. Fl. Edin. ined.*

Ag. edulis, *Bull. Champ.* t. 134. & t. 514. f. L & M.

Pratella campestris, *Gray's Nat. Arr.* v. 1. p. 626.

Mushrooms.

Hab. Pastures and meadows, abundant. Spring to autumn.

Desc. *Plant* gregarious, without particular smell. *Pileus* hemispherical, at length convex, and in old plants nearly plane, fleshy, dry, smooth and sericeous, or slightly squamose, 2—4 inches broad, white, changing to a yellowish or brownish hue in decay. *Lamellæ*

numerous, free, delicate, vinous red or flesh colour, becoming fuscous, and even nearly black. *Flesh* spongy, white, thick. *Stem* firm, solid, white, generally short, and often somewhat bulbous. *Veil* mostly annular and persistent, but sometimes fugacious.

This is the *common mushroom* of this country, the *champignon* of the French, and *prataiolo* of the Italians. It is one of the most generally diffused species we know, being found throughout the whole of Europe, even in Lapland; as far as Japan, in Asia, on the authority of THUNBERG; in Africa (Barbary) DESFONT. *Atlant.* p. 433; and in America, according to MUHLENBERG, and others.

It was well known to the ancients, under various names. Μυκης εδωδιμ of DIOSCORIDES, *Callo rubens* of PLINY, *Prateoli* of CÆSALPINUS, as a *Fungus esculentus* by CLUSIUS, and many others. It is by no means improbable, however, that several species may be confounded together, even by the moderns; and that the popular names in France, such as *paturons*, *potirons*, *envinassas*, *cabalas*, *champignons des près*, *champignons de fumier*, and *champignons de couche*, may not belong to one species. They are all decidedly wholesome, and bear, if really specifically different, a near affinity to each other. The single term *champignon*, however, is considered as exclusively belonging to the species or variety in question, as much as the term *true mushroom* by the natives of this country. DE CANDOLLE thinks there is only one species of *champignon*, or *pratelle à collier*, in which he follows BULLIARD. PERSOON retains two in his *Synopsis Fungorum*, PAULET five, and MICHELI ten! *Vid. De Cand. Essai*, p. 336.

The two plants that PERSOON describes are, the common *champignon*, *Ag. campestris* of authors, and *Ag. edulis*, which will be presently described, for I cannot but think

them different; at any rate, the latter is so well marked as a variety, that it is well known to mushroom-gatherers in this country, and has received peculiar names on the Continent.

Neither the true mushroom, nor the following species, can be confounded with any poisonous ones; as no others have, along with the complete or semicomplete collar (annular veil), gills which change from a pale-flesh or vinous colour to brown, and become at length black.

The mushroom is so well known, that it would be superfluous to particularise the different modes of dressing it for the table. Ample directions are given in the work of M. PAULET; the most common ways are also copied from him into PERSOON'S *Traité*, p. 195.

7. AG. *edulis*, magnus, gregarius, pileo longo-convexo demum planiusculo, candido, lamellis pallido-carneis, nigrescentibus, stipite annulo distincto.

AGARICUS edulis, *Bull. Champ.* t. 514. figs. N. O. P. Q. R. —*Pers. Syn. Fung.* p. 418.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 157. var. *α*.

AG. arvensis, *Schæff. Fung.* t. 310. & 311.

AG. Georgii, *With. Bot. Arr.* ed. 6. v. 4. p. 281. var. 2. —*Sow. Fung.* t. 304.

PRATELLA edulis, *Gray's Nat. Arr.* v. 1. p. 626.

FUNGUS esculentus magnus albus, &c. *Mich. Nov. Gen.* p. 174.

White-caps.

HAB. Woods, pastures, hot-beds, &c. Autumn.

DESC. *Plant* large, gregarious, altogether of a paler colour than the preceding. *Pileus*, when young, hemispherical or oval, gradually becoming convex, and at length plane, very fleshy, 3—8 inches broad, white,

sometimes yellowish in the centre, not unfrequently somewhat squamose. *Lamellæ* numerous, whitish or very pale-flesh colour becoming slowly darker, but at length black, of a more fleshy substance than the preceding. *Stem* 3—5 inches long, thick, firm, solid, white, somewhat bulbous at the base, furnished with a distinct collar or annular veil.

Sowerby mentions, that, in England, this fungus is known to the country people by the name of *white-caps*. In France it is called *champignons des bruyères*, and *boule de neige*; in Piédmont, *prataiolo maggiore bianco buono*.

I was rather doubtful for some time whether *Ag. edulis* of authors was the same as *Ag. Georgii* of our botanists. I have, however, seen the latter vary so much in some respects, especially in the pileus being quite smooth, or somewhat scaly, that I was convinced of their general identity, on reading the following description by M. Paulet, whom Persoon quotes. "*Ce champignon est d'un blanc de neige lorsqu'il est frais, avec des feuillets couleur de rose tendre, quelquefois lilas; sa peau est toujours unie, fine, et n'est point sujette à s'ecailler; à mesure que son chapiteau s'etale, son voile ce déchire pour former le collet; sa surface finit par roussir ou jaunir, et ses feuillets par nourcir. Il forme alors un plateau horizontal.*"

Sowerby, after mentioning their common name in England, observes, that they are constantly sold in the London markets; and though, says he, "their dry and tough quality renders them unfit for the table in any shape, we do not know that they possess any poisonous property." Those which I have tasted myself, certainly were as good as the common mushroom, which is itself tough, if suffered to become too old before it is used. The French even give it

the preference, but never use it after the gills have become dark.

It requires less cooking than the common mushroom, and, in broiling it over a brisk fire, "*c'est l'affaire d'un quart d'heure.*"

8. Ag. *oreades*, pileo carnoso, tenaci, subumbonato, e rufo pallescente, lamellis distantibus, stipiteque solido, tereti, villoso-corticato, pallidis. *Fries.*

Agaricus oreades, *Bolt. Fung.* t. 151.—*With. Bot. Arr.* ed. 6. v. 4. p. 275.—*Purt. Midl. Fl.* v. 2. p. 627.—*Fries Syst. Mycol.* v. 1. p. 127.—*Hook. Fl. Scot.* pt. 2. p. 21.—*Grev. Fl. Edin. ined.*

Ag. pratensis, *Huds. Fl. Angl.* v. 2. p. 616.—*Sow. Fung.* t. 247. (*not good.*)

Ag. coriaceus, *Lightf. Fl. Scot.* v. 2. p. 1020.

Ag. caryophyllæus, *Schæff. Fung.* t. 77.

Ag. pseudo-mouceron, *Bull. Champ.* t. 144. & 528. f. 2.

Ag. tortilis, *De Cand. Fl. Franç.* ed. 3. v. 2. p. 194. *Ejusd. Syn.* p. 40.

Ag. collinitus, *Pers. Syn. Fung.* p. 33. (*exclud. syn. except Sow.*)

Scotch bonnets.

Hab. Meadows, dry pastures, heaths, &c. common. Summer and autumn.

Desc. *Plant* gregarious, often forming fairy-rings. *Pileus* convex, or very obtusely conical, rarely becoming quite plane, and generally more or less umbonate; 1—2 inches broad, coriaceous, smooth; when moist, subpellucid and striated; when dry, very pale, buffish, and opake. *Flesh* thin, except in the centre. *Lamellæ* free, distant, thickish, rather broad, buffish, white. *Stem* 3–4 inches high, 2–3 lines thick, firm,

solid, furnished with a kind of bark or rind, attenuated downwards, and more or less crooked; beneath the pileus it becomes suddenly thickened, so as to form a shoulder, rendering the gills at first sight adnate. It is often radicating.

The French names for this species are, *le mousseron godaille*, *mousseron de Dieppe*, *mousseron d'Orleans*, *mousseron d'automne*, *faux mousseron*, and *mousseron pied-dur*. It is much esteemed on the Continent, though not equally so as the true *mousseron*, on account of its flesh being less abundant and less tender. It is nevertheless in constant request, and is frequently dried, and afterwards used in the form of powder, to add a flavour to many sauces. Dr Paulet says, "*Ce mousseron se conserve bien, donne un goût delicieux aux sauces, et n'incommode point; lorsqu'on veut bien en parfumer les sauces, il n'exige pas une longue cuisson: son parfum très-volatil finiroit par se perdre.*"

In some parts of this country *Ag. oreades* is very abundant, and is the most common species to be seen forming those circles known by the name of *fairy-rings*.

9. Ag. *odorus*, fragrans, planiusculus, plus minusve virescens; pileo lævi; lamellis confertis, pallidis, vix subdecurrentibus; stipite solido subflexuoso.

Agaricus odorus, *Bull. Champ.* p. 567. t. 176. & 566. f. 3.—*Humb. Frib. Spec.* p. 85.—*Sow. Fung.* t. 42. —*With. Bot. Arr.* ed. 6. v. 4. p. 214.—*Pers. Syn. Fung.* p. 323.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 175. *Ejusd. Syn.* p. 35.—*Purt. Midl. Fl.* v. 2. p. 624.—*Fl. Dan.* t. 1611.—*Fries Syst. Mycol.* v. 1. p. 90.—*Grev. Scott. Crypt. Fl.* t. 28.—*Fl. Edin. ined.*

Ag. æruginеus, *Schum. Sælland.* p. 298.

AG. anisatus, *Pers. Obs. Mycol.* pars 1. p. 44.
GYMNOPUS odorus, *Gray's Nat. Arr.* v. 1. p. 606.

HAB. Woods, and fields in their neighbourhood. Autumn. Frequent.

DESC. *Plant* fragrant, scattered, rarely subgregarious. *Pileus* 2–3 inches broad, convex, at length nearly plane, more or less umbonate, and of various shades of green, sometimes bluish-grey, and rarely nearly white, smooth, subirregular, and somewhat fleshy. *Lamellæ* numerous, pale whitish or faint flesh-colour, rather narrow, and scarcely at all decurrent. *Stem* 1–2½ inches long, about 2 lines thick, subflexuose, solid, firm, whitish or greenish.

This species has a most agreeable smell, especially when drying, which strongly resembles that of dried woodroof, or new-mown hay; and one variety has so much the odour of aniseed, that it has been called by some authors *Ag. anisatus*. BULLIARD, who first described the species, has no observation on its qualities; but PERSOON declares it to be wholesome, though without entering into any details. This is the less to be regretted, as, in this country, though frequent in a botanical sense, it is not found in sufficient abundance to pay for the trouble of collecting.

10. AG. *eburneus*, candidus, pileo lævi viscoso, lamellis latis, distantibus, decurrentibus, stipite farcto, longo, apice squamuloso.

AGARICUS eburneus, *Bull. Champ.* t. 118. & 551. f. 2. (malè).—*Pers. Syn. Fung.* p. 364.—*With. Bot. Arr.* ed. 6. v. 4. p. 201.—*Purt. Midl. Fl.* v. 2. p. 622.—*Fries Syst. Mycol.* v. 1. p. 33.—*Grev. Fl. Edin. ined.*

Ag. virgineus, *Batsch, Elench. Fung.* f. 12.—*Sow. Fung.* t. 32.

Ag. jozzolus, *Scop. Fl. Carn.* 2. p. 431.

Ag. nitens, *Sow. Fung.* t. 71.

Ag. cossus, *Sow. Fung.* t. 121.

Ag. elongatus, *Schum. Sælland.* p. 310.

Hab. In meadows, pastures, heaths, rarely in woods. Very common. Autumn.

Desc. *Plant* wholly white, often gregarious. *Pileus* convex, or broadly conical, at length plane, and in age even turned up at the margin, centre obtusely umbonate, smooth, slimy in young plants and in moist weather, when dry shining, 1-2 inches broad, fleshy. *Lamellæ* distant, few, broad, thick, decurrent. *Stem* 1-3 inches high or more, 2-3 lines thick, firm, solid, except in very old plants, somewhat crooked, scurfy or slightly squamose towards the top, often attenuated towards the base.

Persoon, in his *Traité*, keeps up *Agaricus jozzolus* of Scopoli (*Ag. eburneus* of Bulliard, and himself, in *Syn. Fung.*), and gives *Ag. virgineus* as a distinct species. I have not followed Fries in uniting the various synonymes above quoted, without examining the plants in their living state. I must, at the same time, confess, that, from the limited accounts given by some authors of the species they describe, I am not completely satisfied respecting *Ag. eburneus* of Bulliard, whose gills are represented as far too numerous. Sowerby's *Ag. virgineus* is the common appearance of the plant, and the character faithfully pourtrayed; I have no doubt of his *Ag. cossus* being a variety, notwithstanding his report of its villanous smell. Of his *Ag. nitens* I am not so certain. This confusion to the epi-

cure is of little consequence, as both species are equally wholesome, and it matters not which is collected. In Italy one is called *jozzolo*, according to DE CANDOLLE; and *Ag. virgineus* of BATSCH and SOWERBY is known and eaten in France under the names of *mousseron* and *petite oreillette*.

11. AG. *ulmarius*, pileo compacto, carnoso, glabro, pallescente, lamellis emarginatis albis, stipite valido adscendente subtomentoso. *Fries*.

AGARICUS ulmarius, *Bull. Champ.* t. 510.—*Sow. Fung.* t. 67.—*Pers. Syn. Fung.* p. 473.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 138. *Ejusd. Syn.* p. 28.—*Purt. Midl. Fl.* v. 3. p. 200.—*Fries Syst. Mycol.* v. 1. p. 186.—*Grev. Fl. Edin. ined.*

PLEUROPUS ulmarius, *Gray's Nat. Arr.* v. 1. p. 615.

HAB. On trunks of trees, especially old decaying elms, in autumn.

DESC. *Plant* somewhat tufted, or several growing together. *Pileus* compact, 4-9 inches broad, smooth, subcoriaceous, but within very white, soft, but of a remarkably close texture, thick, sometimes marbled with livid spots. *Lamellæ* numerous, broad, white, emarginate, very irregular, adnate, or sometimes slightly decurrent. *Stem* more or less excentrical, according as the plant grows from a perpendicular or an horizontal surface, 2-3 inches long, at least 1 inch thick, solid, incrassated at the base, white, sometimes furfuraceous.

This Agaric, named in France *l'oreille d'Orme*, is scarcely of common occurrence in Great Britain, and has not been admitted to our tables. The flesh has an agreeable

odour. I have not met with any directions how to dress it. De Candolle observes, that in Italy there are several species of the same section (*Pleuropus, Pers.*) commonly eaten, and distinguished by the names of *gelone, cardena, cerrena* and *ragagno;* but he cannot speak with precision as to the species.

Sowerby says, this species sometimes attains the prodigious size of two or even three feet in circumference, and that he has seen it constant to the same tree for several successive years.

12. Ag. *ostreatus*, substipitatus, imbricatus, pileo carnoso plano-convexo, cinereo vel fusco, lamellis decurrentibus basi anastomosantibus.

Agaricus ostreatus, *Jacq. Fl. Austr.* t. 288.—*Curt. & Hook. Fl. Lond.* ed. 1. & 2. t. 116.—*With. Bot. Arr.* ed. 6. v. 4. p. 362.—*Pers. Syn. Fung.* p. 477.—*Fries Syst. Mycol.* v. 1. p. 182.—*Grev. Fl. Edin. ined.*
Ag. dimidiatus, *Bull. Champ.* t. 508.
Ag. nigricans, *Fl. Dan.* t. 892.
Ag. atro-albus, *Otto.* p. 102. (fide Fries.)
Crepidopus ostreatus, *Gray's Nat. Arr.* v. 1. p. 616.

Hab. Trunks of trees. Spring and autumn.

Desc. *Plant* growing in a cæspitose or imbricated manner. *Pileus* at first dark-grey, at length brownish, sometimes even yellowish, 3–7 inches broad, plano-convex, smooth, margin rounded and involute, coriaceous. *Lamellæ* numerous, whitish, broad, decurrent and anastomosing at the base. *Stem* very short, or none; when present, mostly lateral, solid; most generally absent in large plants.

This species is liable to be confounded with *Ag. conchatus* of Bulliard and *Ag. glandulosus* of the same author; from the latter, indeed, it seems only to differ in wanting the very curious glandular bodies between the gills. In this difference, however, it is constant. All the three species are perfectly innocent.

Agaricus ostreatus is known in France by the name of *d'oreille de noiret*, and in the *Pays des Voges* by that of *couvrose*.

Fries, under this plant, refers to a work by Trattinick on the Esculent Fungi of Austria, which I regret not finding in the public libraries of Edinburgh, as I have not yet been able to procure a copy from the Continent.

13. Ag. *violaceus*, obscure violaceus, pileo margine villoso, lamellis distantibus, stipite spongioso, intus violaceo-cinereo.

Agaricus violaceus, *Linn. Fl. Suec.* p. 448.—*Hedw. fil. Obs. Bot.* t. 4.—*Bolt. Fung.* t. 52.—*With. Bot. Arr.* ed. 6. v. 4. p. 260.—*Sow. Fung.* t. 209.—*Hook. Fl. Scot.* pt. 2. p. 20.—*Fries Syst. Mycol.* v. 1. p. 217. *Grev. Fl. Edin. ined.*

Ag. hercynicus, *Pers. Syn. Fung.* p. 277.

Cortinaria violacea, *Gray's Nat. Arr.* v. 1. p. 628.

Bluets.

Hab. Woods, and waste grounds in their neighbourhood.

Desc. *Plant* of a dull violet or obscure purple tinge. *Pileus* convex, fleshy, rounded, in old plants sometimes depressed in the centre, 3–5 inches broad, faint violet or violet-brown, colour brightest at the margin, where it is also more or less fibrillose. *Flesh* thick, spongy, tinged with grey-violet. *Lamellæ* adnate,

tinged more or less with violet, numerous, irregular. *Stem* tomentose in young plants, 3-4 inches long, $\frac{1}{2}$–$\frac{3}{4}$ of an inch in diameter, bulbous, solid, spongy, flesh darker than in the pileus. *Veil* cobweb-like, fugacious.

Agaricus violaceus does not seem to be very highly prized either in this country or on the Continent. SOWERBY, in a note at the end of the index to his Fungi (in Engl. Bot.), mentions that it is sold in the English markets under the name of *bluets*, but that it is not good for much. PERSOON has not admitted it into his catalogue of edible species; but incidentally alludes to its being eaten in some countries....*Traité*, p. 163. DE CANDOLLE observes, that *Ag. araneosus* and *Ag. violaceo-cinereus*, which bear the nearest affinity to *Ag. violaceus*, are eaten in Italy, and named *fungo vedovo* and *grumato paonazzo.*

Confusion seems still to exist between some of the species of this group, and as it contains several that are considered poisonous, great caution should be observed in regard to them. The plant commonly sold as *bluets*, and that which has the nearest resemblance to it (*Ag. glaucopus*, *Sow.* t. 223. which I suspect may not be specifically distinct), are quite innocent, and may either be eaten like the common mushroom, to which they are similar in flavour, or be made into ketchup.

14. AG. piperatus, pileo infundibuliformi, rigido glabro, albo, lamellis angustissimis, confertis, lacte stipiteque solido, obeso albis. *Fries.*

AGARICUS piperatus, *Scop. Fl. Carn.* p. 449....*Bolt. Fung.* t. 21....*Fl. Dan.* t. 1132....*Pers. Syn. Fung.* p. 429....*Fries' Syst. Mycol.* v. 1. p. 76....*Grev. Fl. Edin. ined.*

AG. amarus, *Schæff. Fung.* t. 83.

HAB. Woods. Summer and autumn.

This species is eaten in Germany, France, Italy, and Russia; but is not much commended. The Italian name is *fungo peperone*, and in the Pays des Voges it is called *auburon* and *vache blanche*.

15. AG. acris, pileo viscoso azono, cinereo-fuligineo, lamellis flavis, lacte ex albo rubescente, stipite farcto. *Fries.*
AGARICUS acris,. *Bolt. Fung.* t. 60....*With. Bot. Arr.* ed. 6. v. 4. p. 224. ..*Pers. Syn. Fung.* p. 437....*Fries Syst. Mycol.* v. 1. p. 65.

HAB. Near and *in* woods. Common. Autumn.

Both the preceding species are eaten on the Continent, as well as *Agaricus Listeri*, which is *Ag. acris* of BULLIARD, t. 588. figs. c. d. e. f.; and FRIES considers many more as wholesome. I have not described or entered into any details respecting them; for they approach so very near to species decidedly poisonous, that they had better be dismissed entirely from the list of eatable kinds; particularly as the discriminating characters are too nice for common observers. DE CANDOLLE, speaking of this group of lactescent fungi, says, "La plupart sont vénéneux, et quoique quelques-uns servent d'alimens, je crois que, vu l'extrême difficulté de les distinguer, il est plus prudent de s'en méfier."

The following species, however, is fortunately well marked, although belonging to the same suspicious group.

16. AG. deliciosus, pileo viscoso, obsolete zonato aurantio-expallente, lamellis lacteque aurantiacis, stipite cavo glabro, scrobiculato. *Fries.*

AGARICUS deliciosus, *Linn. Fl. Suec.* 1211.—*Schœff. Fung.* t. 11.—*Sow. Fung.* t. 202.—*Pers. Syn. Fung.* p. 432.—*With. Bot. Arr.* ed. 6. v. 4. p. 219.—*Purt. Midl. Fl.* v. 3. p. 187.—*Fries Syst. Mycol.* v. 1. p. 67. —*Grev. Fl. Edin. ined.*

AG. zonarius, *Bolt. Fung.* t. 141.

LACTARIUS deliciosus, *Gray's Nat. Arr.* v. 1. p. 624.

LACT. lateritius, *Pers. Disp.* p. 64.

HAB. Woods. July to November. Not unfrequent.

DESC. *Plant* exuding an orange juice, which changes to a livid green; the plant also turning green on being wounded. *Pileus* plano-depressed, sometimes in age approaching to funnel-shape; 2–4 inches broad, dull orange or brick colour, becoming dingy and pale, and often greenish in decay; glutinous, smooth, obscurely zoned. *Lamellæ* somewhat decurrent, bright reddish orange, frequently but not always nor regularly dichotomous, narrow, turning green on being wounded. *Flesh*, pale orange. *Stem* solid, becoming hollow, 2 inches high, orange, somewhat attenuated at the base.

A universally approved species throughout the whole of Europe, named by the Piémontais *Lapacendro buono* and *Goccia liquore colore di zaffrano.* I have not been able to ascertain the French provincial names.

Sir JAMES EDWARD SMITH, in his Tour on the Continent, mentions having seen a prodigious quantity of this agaric exposed to sale in the market at Marseilles, and that it really deserved its name, being the most delicious fungus known. SOWERBY also speaks in its favour, having dressed and eaten it. His question, whether it be the true *Ag. cæsareus*, as well as WITHERING's errors respecting the two plants I have already discussed.

This species must not be confounded with *Ag. theiogalus* of BULLIARD, t. 567. f. 2., the juice of which is yellow, and whose surface is also zoned. It is, however, only half the size, and, besides being of a pinkish red colour, has never been seen with orange juice, or to turn green when bruised.

The taste of *Ag. deliciosus* is rather acrid and disagreeable, but this is entirely removed by cooking.

CANTHARELLUS.

17. *C. cibarius*, vitellinus, pileo carnoso, subrepando, glabro, plicis tumidis, stipite solido, deorsum attenuato.

CANTHARELLUS cibarius, *Fries Syst. Mycol.* v. 1. p. 318. —*Grev. Fl. Edin. ined.*

CANTHARELLUS vulgaris, *Gray's Nat. Arr.* v. 1. p. 636.

MERULIUS cantharellus, *Pers. Syn. Fung.* p. 418.—*With. Bot. Arr.* ed. 6. v. 4. p. 196.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 128.—*Hook. Fl. Scot.* pt. 2. p. 25.

AGARICUS cantharellus, *Linn.*—*Bull. Champ.* t. 62. et t. 505. f. 1.—*Fl. Dan.* t. 264.—*Bolt. Fung.* t. 62.—*Sow. Fung.* t. 40.

HAB. In woods, and borders of fields. July to November.

DESC. *Plant* wholly buff, or of the colour of yolk of egg. *Pileus* irregular, subrepand, often almost lobed, 2–4 inches broad, depressed in the centre, margin rounded and often involute, smooth. *Veins* subdistant, prominent, tumid, dichotomous, sometimes anastomosing. *Stem* 1–2 inches long, 2–3 lines thick, attenuated downwards, and seldom quite straight, firm and solid.

Flesh buff. When recent, scentless; but in a few hours smelling like ripe apricots.

According to PERSOON, this is the most abundant of all the eatable fungi, especially in France, where it has received a number of popular names, as, *chanterelle*, *girille*, *girolle*, *gérille*, *escau*, *virolle*, *girandet*, *gingoule*, *escraville*, *cassine*, *chevrille*, *chevrette*, *mousseline*, *jeannelet*, *&c.* In Italy it is called *galinattio.* In some provinces, it is asserted by the same author, that it forms almost the only article of food. *Pers. Traité*, p. 228. DE CANDOLLE affirms it to be a species possessing little delicacy, but one that cannot be confounded with any that are dangerous. Whatever may recommend it, it is certainly as much used as food, and as seasoning to dishes, as any other. *Vid.* BULLIARD and PERSOON. It is dressed either with butter, lard, or oil, pepper and salt; frequently with the addition of onions. Some eat it fresh, only with vinegar, oil, pepper and salt. It is also used in fricassées, or dried and mixed with all kinds of ragouts.

In this country, the *chanterelle* is not so plentiful as many other edible fungi. SOWERBY, however, says, they are often eaten, and they are certainly sufficiently common to render the collecting of them desirable.

BOLETUS.

18. B. *edulis*, pileus amplus, glabrus, tubulis semiliberis, subrotundis, minutis albis, flavescentibus, stipite crasso reticulato.

BOLETUS edulis, *Bull. Champ.* p. 322. t. 60. et t. 494. —*Pers. Syn. Fung.* p. 510.—*With. Bot. Arr.* ed. 6. v. 4. p. 381.—*Sow. Fung.* t. 111.—*De Cand. Fl.*

Franç. ed. 3. v. 2. p. 124. *Ejusd. Syn.* p. 25.—*Purt. Midl. Fl.* v. 2. p. 663.—*Fries' Syst. Mycol.* v. 1. p. 392. —*Grev. Fl. Edin. ined.*

B. bulbosus, *Schœff. Fung.* t. 134. et t. 135.

B. esculentus, *Pers. Obs. Mycol.* 1. p. 23.

B. crassipes, *Schum. Sœlland.* p. 378. fide Fries.

Leccinum edule, *Gray's Nat. Arr.* v. 1. p. 647.

Hab. In woods. Common. Autumn.

Desc. *Pileus* convex, or even hemispherical, becoming more dilated in age, smooth, large, 3–6 inches broad, almost shining, spongy, reddish-brown, dingy yellow, cinereous or whitish, cracking sometimes in dry weather so as to appear reticulated. *Flesh* white, either not changing colour, or slightly reddening, taste pleasant. *Tubes* long, white, at length yellowish, or greenish. *Stem* sometimes short, thick, "ovato-bulbous," or 4–5 inches long, and nearly equal; pale, whitish, or tinged with brown, reticulated. *Sporules*, according to Fries, dark and ochreous.

So much use is constantly made of this excellent fungus on the Continent, that it is surprising how it has been so long neglected in this country. In France, it is well known by the names of *bruguet*, *ceps*, *cèpe*, *gyrole*, *bole*, *porchin*, *potiron*, *issalon*, *mourses*, *cepe-franc tête rousse*; and in Italy, by those of *potello*, *ceppatello*, *scuro*, *ghazzo*, *pinuzzo buono*, *porcino*, *&c*

In preparing this Boletus, of which Fries says, "*species in cibariis laudatissima*," for the table, the skin must be peeled off, and the *hymenium* or tubes removed; the latter, it may be observed, are in all species to be avoided. Some people eat the stem, but it is rather tough. Old plants should not be taken.

This fungus is used in white sauce, or fricassées; or broiled or baked, with fresh butter, olive-oil, pepper and salt, bread-crumbs, and fine herbs. Some persons add ham and minced anchovies. Even *beignets* and excellent creams are made from it. It is frequently eaten raw, *à la poivrade.* According to BULLIARD, it is also sliced, and, being carefully dried, is regularly sent from Provence under the name of *cèpe.*

In Hungary, on the authority of PAULET, *Bol. edulis* is made into a soup, which is much liked. The manner of cooking it is this:—The fungi prepared as above directed, are placed for a short time in an oven or stove, and then steeped in tepid water. In this water toasted bread is boiled until the whole has become of a thick consistence (*consistence de purée*), when the fungi, partly dressed with butter and proper seasonings, are to be added.

19. B. *scaber*, pileo pulvinato, glabro, tubulis liberis, rotundis, albis, stipite firmo, attenuato, squamoso-scabro.

BOLETUS scaber, *Bull. Champ.* p. 319. t. 132. et 489. f. 1.—*Sow. Fung.* t. 175.—*Pers. Syn. Fung.* p. 505. —*Fries Syst. Mycol.* v. 1. p. 394.—*Pers. Traité,* p. 235.

B. viscidus, *Linn. Fl. Suec.* p. 452.

B. procerus, *Bolt. Fung.* t. 86.

B. aurantiacus, *Bull. Champ.* p. 320. t. 236. et 489.—*Pers. Traité,* p. 234.—*Sow. Fung.* t. 110.—*Hook. Fl. Scot.* pt. 2. p. 26.

B. aurantius, *Pers. Syn. Fung.* p. 504.

B. leucopodius, *Pers. Obs. Mycol.* 2. p. 11.

B. rufus, *Schæff. Fung.* t. 103.

B. bovinus, *Schæff.* t. 104.

HAB. Woods, borders of fields, &c. Summer and autumn; frequent.

DESC. *Pileus* convex above and below, 2–5 inches broad or more, humid, somewhat glutinous, sometimes scaly, and in dry weather losing its gluten and cracking, of various colours, orange, red, brownish, olivaceous, livid, or dark-grey. *Flesh* white, either not changing or turning blackish. *Tubes* long, white, orifice minute, obtuse, at length dingy, free. *Stem* whitish, long, attenuated above, particularly at its attachment to the pileus, firm, scabrous, with dark furfuraceous minute scales.

PERSOON, in his *Traité*, keeps *Bol. aurantiacus* and *scaber* distinct, but observes that they possess the same properties; and DE CANDOLLE, in his *Essai*, so frequently quoted in these observations, states them to be confounded together throughout the greater part of France under the names of *roussile* and *gyrole rouge*, and in Italy under that of *leccino*. It is called *lingua di leccio* in Piémont.

According to BULLIARD and others, it is eaten either broiled, or in the form of white sauce. It ought to be gathered while young, as in old plants the flesh becomes disagreeably soft and insipid.

In the determination of the species, I have followed FRIES, and given his description almost verbatim. I examined a great number of specimens this autumn (1822) in the Highlands of Scotland, and fully agree with him in the union, not only of *B. scaber* and *aurantiacus*, but of the other varieties brought together in the synonymes.

Fistulina.

20. *F. hepatica.*

Fistulina hepatica, *With. Bot. Arr.* ed. 6. v. 4. p. 371. —*Fries' Syst. Mycol.* v. 1. p. 396.—*Gray's Nat. Arr.* v. 1. p. 648.

Fist. buglossoides, *Bull. Champ.* p. 314. t. 74. 464. et 496.—*Pers. Traité*, p. 245.

Boletus hepaticus, *Huds. Fl. Angl.* v. 2. p. 625.—*Schæff. Fung.* t. 116. & 120.—*Sow. Fung.* t. 58.—*Bolt. Fung.* t. 79.—*Pers. Syn. Fung.* p. 549.—*De Cand.* ed. 3. v. 2. p. 113.—*Lightf. Fl. Scot.* p. 1034. —*Hook. Fl. Scot.* pt. 2. p. 26.

Bol. buglossum, *Fl. Dan.* t. 1039.

Hab. Trunks of trees, especially the oak. Autumn.

Desc. *Plant* of no regular form, entire or lobed, sessile or supported on a short thick stem, colour like that of an ox-liver; substance fleshy and very juicy, becoming glutinous in age, when cut, the flesh is more or less flesh-red, and somewhat marbled or zoned. *Pileus* 3–6 inches long, 3–4 broad, at first bright-red, which gradually darkens; surface scattered over with little eminences, resembling, under the glass, minute roses, which fall off, and are nothing more than the rudiments of tubes. *Hymenium* or under surface plane, yellowish, or pale reddish. Tubes pale whitish or yellowish, crowded, distinct, and separated by fleshy fibres, ½ an inch long, the mouths denticulated.

The only species of the genus, which is characterized by the tubes being distinct, and separated from each other by an intervening substance.

This extraordinary fungus is certainly not very tempting in appearance, but is very generally eaten and esteemed. PAULET says it is an agreeable food, and that a single fungus is sufficient for an ample repast; also, that young plants are to be preferred, as in age the surface becomes too viscid, and the interior ligneous. There are two modes, according to him, of using it; the one, roasting under the embers; the other, in *fricassée de poulet.* The seasoning should always be *piquant.* Vinegar has been ascertained not to suit this species, and it spoils the sauce.

TRATTINICK, as quoted in PERSOON, *Traité*, p. 247, reports, that, in Austria, they cut it into slices, and eat it, as a sallad, with endive, &c. They also dress it with veal, adding cream and lemon juice.

The French call this plant *foie de bœuf, langue de bœuf, glue de chene, langue de chene.* In Tuscany it is known by the name of *lingua de castagno,* or *lingue* only; and in Piémont by that of *langhe.*

Old authors, on the *Materia Medica*, call it *hypodris.*

HYDNUM.

21. *H. repandum*, pileo carnoso, subrepando, glabro, azonono, aculeis inæqualibus, stipiteque difformi pallidis. *Fries.*

HYDNUM repandum, *Linn. Fl. Suec.* 1258.—*Fl. Dan.* t. 310.—*Bull. Champ.* t. 172.—*Sow. Fung.* t. 176.—*With. Bot. Arr.* ed. 6. v. 4. p. 403.—*De Cand. Fl. Franç.* ed 3. v. 2. p. 111.—*Pers. Syn. Fung.* p. 555.—*Purt. Midl. Fl.* v. 3. p. 450.—*Hook. Fl. Scot.* pt. 2. p. 28.—*Grev. Fl. Edin. ined.*—*Fries Syst. Mycol.* v. 1. p. 400.

HYD. imbricatum, *Bolt. Fung.* t. 87.
HYD. flavidum, *Schæff.* t. 318.
HYD. rufescens, *Schæff.* t. 141.
HYD. carnosum, *Batsch, Elench. Fung.* f. 136.
HYD. clandestinum, *Batsch,* l. c. f. 44.
HYD. medium, *Pers. Obs. Mycol.* 2. p. 97.

HAB. Woods; frequent. Summer and autumn.

DESC. *Plant* solitary or gregarious, pale buff, sometimes turning reddish. *Pileus* repand, irregular, lobed, or entire, depressed in the centre, margin mostly rounded, smooth, brittle. *Flesh* pale, buffish, not changing colour when cut. *Awl-shaped processes* of the *hymenium,* irregular, unequal, generally entire at the apex, but sometimes jagged, and almost hollow, $\frac{1}{6}$ of an inch in length. *Stem* thick, unequal, often deformed, solid, expanding into the pileus, $1\frac{1}{2}$–2 inches long.

This *Hydnum* is regularly sold in France and Austria. In the former it has acquired the appellations of *eurchon, chrevrette, chevratine, rignoche,* and *arresteron.* The Italians, at least in Tuscany, name it *steccherrino* and *dentino-dorato.* In the Pays des Voges it is also called *pied de mouton* and *barbe de vache.*

No mistakes can arise in the choice of this fungus. On the Continent, indeed, *Hydnum album* might be gathered for it by very inattentive persons, but that is even superior to the present species as an article of food. The flavour somewhat resembles that of the *chanterelle,* and is improved in the same way by cooking. It is often broiled; but M. PAULET says, the best manner of dressing them is to plunge them for a short time into boiling water, and then commit them "*à la graisse et au bouillon,*" as having little

juice of their own. They are rather tough when dressed with butter, and require a liquid vehicle.

This species is tolerably abundant in this country; and no one need be under any apprehensions, as the whole genus is wholesome, and well defined, by having their *hymenium*, or seat of fructification, composed of little spinous or awl-shaped processes.

Hydnum imbricatum, *H. erinaceum*, and *H. caput-medusæ*, are all used on the Continent as food; but they are too rare in this country ever to be applied to a similar purpose: to describe them here would be therefore superfluous.

Clavaria.

22. *Cl. coralloides*, alba, erecta, caule crassiusculo, ramis elongatis, inæqualibus, apicibus plerumque acutis.

Clavaria coralloides, *Linn. Fl. Suec.* 1268.—*Sow. Fung.* t. 278. fig. sup.—*With. Bot. Arr.* ed. 6. v. 4. p. 437. var. 2.—*Hook. Fl. Scot.* pt. 2. p. 29.—*Fries Syst. Mycol.* v. 1. p. 467.—*Grev. Fl. Edin. ined.*

Cl. alba, *Pers. Mycol. Europ.* v. 1. p. 161.

Ramaria coralloides alba, *Holmsk.* v. 1. p. 113. cum fig.

Hab. On the ground, among grass, &c. especially after much rain. Autumn.

Desc. Very smooth and white, but sometimes with a violet tinge at the base; variously branched. Branches elongated, unequal, and generally acute at their summits.

23. *Cl. cinerea*, ramosa incrassata, ramis coralloideis, rugosis, dilatatis, glabris, solidis subcompressis.

CLAVARIA cinerea, *Bull. Champ.* p. 204. t. 354. malè. —*Pers. Syn. Fung.* p. 586.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 100.—*Fries Syst. Mycol.* v. 1. p. 468. *Grev. Fl. Edin. ined.*

CL. fuliginea, *Pers. Mycol. Europ.* v. 1. p. 166.

CL. grisea, *Pers. Comm.* p. 44. et *Syn. Fung.* p. 586.—*Fries Syst. Mycol.* v. 1. p. 468.

RAMARIA cinerea, *Gray's Nat. Arr.* v. 1. p. 656.

HAB. Woods, borders of fields, and shaded places among grass, frequent. Autumn.

DESC. 1–4 inches high or more, solitary or gregarious, tufted, much branched, pale, cinereous, bluish, purple-grey, or sometimes even approaching to flesh-colour. *Stem* very short, $\frac{1}{4}$–$\frac{3}{4}$ of an inch thick, dividing immediately into several thick irregular branches. *Branches* unequal, rugose, smooth, often producing a number of little incrassated divisions, summits somewhat dilated, subcompressed, mostly obtuse and knobby, or even bluntly palmate, rarely unequally cylindrical and acute.

The above two species are very generally employed as food in France, where the inhabitants name the former *barbe de bouc, bonquinbarde, gantelines, gallinoles, fripettes, chevelines, pied-de-coq, poule, mousse, barbes, mainottes, menottes, barbe de chèvre, espignettes, pattes d'alléor, diables, balais, &c. &c.* and use the same terms to designate the latter, adding only the epithet *grise.* In Italy they are called *ditola gialla, ditola rossa,* and *ditola bianca,* according to the colour of the varieties. DE CANDOLLE justly observes, that they may be considered as among the least hazardous of all fungi, as they bear no resemblance, even remote, to dangerous kinds: he does not, however, think them eminently delicate.

M. PAULET's mode of cooking them, is to stew them with a little butter, and, when they have become softened, to throw off the water which has come from them, and replace them on the fire with butter, parsley, and young onions, sprinking the whole gently with flour; they are afterwards moistened with "*bouillon*," to which yolks of eggs are added to complete the process.

Others dress them with lard, adding salt, pepper, some ham, and a little parsley; this requires about an hour; afterwards they are put into a gravy-sauce, or a fricassée of fowls. Care must be taken to cover the stew-pan with paper beneath the lid, in order to prevent the flavour from escaping.

In some parts of Great Britain the *Clavariæ* are abundant.

MORCHELLA.

24. *M. esculenta*, pileus rotundatus, margine contracto, areolis profundis; stipite albo, cylindrico, basi dilatato.

MORCHELLA esculenta, *Pers. Syn. Fung.* p. 618. et *Mycol. Europ.* v. 1. p. 206.—*De Cand. Fl. Franç.* ed. 3. v. 2. p. 213. *Ejusd. Syn.* p. 43.—*Hook. Fl. Scot.* pt. 2. p. 31.—*Gray's Nat. Arr.* v. 1. p. 661.—*Grev. Fl. Edin. ined.*

HELVELLA esculenta, *Sow. Fung.* t. 51. fig. sinistra.

PHALLUS esculentus, *Linn.*—*Schœff. Fung.* t. 199.—*Bull. Champ.* t. 218. f. a—d.—*Bolt. Fung.* t. 91.——*With. Bot. Arr.* ed. 6. v. 4. p. 428.

Morell.

HAB. On the ground, in woods, &c. loving a sandy soil,

and springing up most plentifully where fires have been made. Spring.

DESC. *Plant* 2–5 inches high. *Pileus* roundish or oval, from the size of a pigeon's to that of a swan's egg, closely contracted at the base, round the stem; cellular like a honey-comb, cells deep. *Stem* hollow, white, cylindrical, somewhat dilated towards the base. Scent agreeable.

All the Morells are excellent; and as, in old authors, and many modern ones, several species are confused together, the following observations apply to the *genus*, or all the species collectively.

The Morelle is one of our most celebrated fungi for the table. CLUSIUS places it among his principal edible mushrooms, and every botanist since his time has more or less commended it.

Throughout the greater part of Europe it is known by the names of *morille*, *morchelle*, *morchelen*, *spagniole*, *spongignole*, *spongiola*, and *pungola*. The name *Morchell* seems, from CAMERARIUS, to have originated with the Germans, who, according to PARKINSON, "be much delighted with them." In Piémont they are called *spugnino*, *spugnolo buono*, and *tripetto*.

The best manner of dressing the *Morelle*, I shall translate from PERSCON's *Traité*, p. 257. "Besides the use made of *Morelles* in many ragouts, they are also served by themselves, and much esteemed. After having well washed them to remove the soil they are liable to contain in the areolæ of the pileus, they must be well drained and dried, and then put into a stew-pan, along with butter, pepper, salt, parsley, and sometimes a little ham. They require about an hour's cooking; and as they do not produce much moisture themselves, it is necessary to add a little gravy

now and then. In removing them from the fire, the addition of a few yolks of eggs is usually made, to firm them. Some people add a little cream. They are served by themselves, or on a buttered toast."

M. PAULET gives directions for *stuffing* Morelles; for which purpose the freshest specimens must be selected. They are opened at the insertion of the stems, and filled with fine stuffing, then broiled with lard, and served up with champaigne, lemon-juice, and bread-crumbs.

In Austria, they stuff Morelles with bread-crumbs, the the flesh of fowls, pickled pilchards, craw-fish, and probably lobsters.

In Germany, it was ascertained by the country people, that they grew most abundantly in places where fires had been made; and, in order to encourage their production, the woods frequently fell a sacrifice. The law was at length obliged to interfere, and the Morelle was left to spring up in the due course of nature.

It appears almost unnecessary to guard the morelle-gatherer against the *Phallus fœtidus*, which has a smell so bad, as rather to repel instead of attracting intimate notice. It has, however, besides, a *volva*, or wrapper; and the cells of the pileus are not visible till a viscid dark-green slime has fallen, or been eaten by flies.

HELVELLA.

25. *H. Mitra*, pileo livido, inflato, adnato, stipite sulcato-lacunoso, pallido.

HELVELLA mitra, *Linn. Sp. Pl.* 1649.—*Bull. Champ.* p. 298. t. 190. & t. 466.—*Pers. Syn. Fung.* p. 615. —*De Cand. Fl. Franç.* ed. 3. v. 2. p. 94. *Ejusd. Syn.* p. 19.—*With. Bot. Arr.* ed. 6. v. 4. p. 406.—

(excl. *Syn. Sow.* t. 39.)—*Nees' Syst. Fung.* t. 18. f. 163.—*Hook. Fl. Scot.* pt. 2. p. 31. (excl. *Syn. Sow.* t. 39.—*Purt. Midl. Fl.* v. 3. p. 255. t. 16. (central fig. ?)—*Grev. Scott. Crypt. Fl.* t. 39.—*Fl. Edin. ined.*

ELVELLA mitra, *Œder Fl. Dan.* t. 116.

HELVELLA lacunosa, *Holmsk.* v. 2. p. 45. t. 24.

HEL. sulcata, *Willd. Berol.* p. 398.

ELVELLA nigricans, *Schœff. Fung.* t. 154.

EL. monacella, *Schœff.* l. c. t. 162.

HAB. On the ground, in woods and shaded places, among grass. Autumn.

DESC. *Pileus* membranaceous, smooth on both sides, of different shades of colour, but generally dark and livid, inflated, irregular in form, deflexed at the sides, and partially adnate with the stem; from being thus folded down, 2 or 3 prominent ascending lobes are produced, often giving the resemblance of a mitre. *Stem* 2—6 inches high, ½—1½ inches thick, whitish, channelled, and lacunose or pitted, variously divided through its whole substance into longitudinal cavities, the partitions of which are semitransparent like wax. *Sporuliferous cells* on the upper surface, throwing out their sporules in the form of an elastic powder.

This species has long been confounded with others by the botanists of this country; SOWERBY's figure being the following, and BOLTON's *H. elastica.* I believe, in every state, *H. mitra* will be found with the pileus more or less adnate with the stem. In the smaller figure of the plate, in *Scottish Cryptogamic Flora,* I have represented a specimen, which, at first sight, much resembled *H. leucophœa;* the pileus was, however, partially adnate, a circumstance I never observed in that species.

26. *H. leucophœa*, pileo deflexo, irregulariter lobato, libero, pallido, stipite sulcato, lacunoso, albo.

HELVELLA leucophœa, *Pers. Obs. Mycol.* 2. p. 19. et *Syn.* p. 616. et *Mycol. Europ.* v. 1. p. 210.—*Gray's Nat. Arr.* v. 1. p. 662.—*Grev. Fl. Edin. ined.*

HEL. mitra, *Sow. Fung.* t. 39.—*Purt. Midl. Fl.* v. 2. p. 678. et v. 3. p. 451. t. 16.

HAB. In the same places as the preceding, and in this country much more common. Autumn.

DESC. Size the same as the preceding, but more prone to monstrosity. *Pileus* quite free, generally more or less lobed, or even crisped and curled; upper surface yellowish-white, pale-brownish beneath. *Stem* somewhat ventricose towards the base, deeply lacunose, white, often very thick.

The *Helvellæ* are very similar to the *Morelles* as articles of food, and, like the Morelles and the Truffles, there are no poisonous species. According to ALLIONI, *H. mitra* is eaten in Piémont; and DE CANDOLLE mentions having seen an analogous species (probably *H. leucophœa*), used in the environs of Aignes-mortes under the name of *oreillette*.—*Essai sur les Proprietés Med. des Plantes*, p. 324.

On the authority of PERSOON, it is employed in the neighbourhood of Paris in the same way as Morelles. The same author has also a remark, that the larger *Pezizæ* may be eaten without fear, and prepared in the same manner.

EDINBURGH,
December 12. 1822.

XXVIII.—*Notice relative to the Habits of the Hyena of Southern Africa.*

By R. Knox, M.D. M.W.S.

(*Read 28th December* 1822.)

Some of the habits of the hyena of modern times seem to me to afford an objection, which, so far as I know, has not yet been offered to Professor Buckland's speculations as to the mode in which the bones of various animals have been introduced into the Cave of Kirkdale, in Yorkshire. The Society is aware that Professor Buckland ascribes their presence to the agency of antediluvian hyenas, to whom this cave served as a place of retreat, and whither they retired with their prey, in order to feast on it more at leisure than they could well do in the open country, and by cracking the bones leave nothing they could possibly devour. Now, this theory, so far as regards the hyena, rests, in my humble opinion, on a misapprehension of the habits of that animal. Two varieties of the hyena abound in the southern peninsula of Africa, viz. the spotted or tiger-wolf of the colonists, and the striped: these infest the

whole country, attacking almost every animal but man; they prefer, however, as being easier procured, the carcases of animals which have either died of disease, or fallen under the hands of the huntsman. The carcase they often drag away to a considerable distance from the place where it fell; but I have almost always been able to discover the skeleton, and that often, tolerably entire. Negative evidence, I am aware, is never reckoned so good as positive; and while I assert, that the carcases of animals killed at a distance from human habitations are generally devoured on the spot by the hyena, vulture, &c.—a fact proved by the bones being found scattered about, and often confined to a small space,—yet I do not wish it to be understood that I deny that hyenas ever drag their prey, including the bones, to the caverns, or wild mountain-tracts, they inhabit. Many instances occurred, however, which indicate that they do not; and the most remarkable happened to me whilst surveying the exceedingly wild district bordering the Great Fish River and Caffraria. A large elephant had been killed about two months before, and had fallen in the centre of a forest of bush, infested with hyenas, panthers, and other beasts of prey. I proceeded to the spot, with a view of examining the grinding-teeth, and was surprized to find almost the whole skeleton present, perfectly well cleaned, but almost untouched. It seemed to me, that, had I been so inclined, I might have collected almost every bone, or at least a specimen of each, uninjured.

Again, at the distance of many months, we used to visit the spots where large elephants, hippopotami, or buffaloes fell, and never failed to discover the remains of the skeletons, often exceedingly perfect. On the deserts lay the skeletons of numerous antelopes, which had fallen a sacrifice to the lion and panther; and even close to the abode of man, the carcases of sick oxen, sheep, horses, &c. are de-

voured by the hyena, and the bones left within a hundred yards of the inhabited buildings. In 1819, a dreadful drought devastated the country; the pastures were parched up, and the cattle died in vast numbers of hunger and thirst: now the carcases lay within a few yards of the farm-houses, and were there devoured by hyenas; but never, so far as I know, were they carried off. The animals which carry off their prey are the lion and panther, but not the hyena or wild dog. I have, moreover, remarked, that the young of these animals follow them early into the field, so that I much question if they ever carry a portion of their prey, on any occasion whatever, to their dens. I may finally observe, that I have often roused the hyena from his lurking place; but, assuredly, these places bore no resemblance to charnel-houses.

I entertain no hopes that this brief notice shall in any way induce Professor Buckland and his supporters to change their theory, which, after all, is perhaps the best hitherto offered. It may be said that antediluvian British hyenas may have differed much in their habits from the postdiluvian ones of southern Africa. Moreover, the animal called a Hyena, and whose bones exist in such abundance in the Cave of Kirkdale, is allowed to have been much larger than the African one; it may fairly be asked, Was it a hyena? The tiger-bones, also found there, are supposed to have belonged to a variety larger than the Bengal or royal tiger; and the bear is described as being as large as a horse. Now, the fair inference from all this is, that these bones may possibly be the remains of hyenas, bears, and tigers; but that it is just as probable that they are not.

Edinburgh,
December 10. 1822.

XXIX.—*An Account of Three large Loadstones, one of which presented an unusual Line of Attraction.*

By JOHN DEUCHAR, M. W. S.
and Lecturer on Chemistry in Edinburgh.

(*Read* 10*th March* 1821.)

WHEN we come to try the magnetic energy of large loadstones, or natural magnets, we seldom find them to display that force, in proportion to their size, which we should expect. This circumstance seems to have drawn to it the attention of philosophers at a very early period of the history of magnetism; and hence, from the various facts they had noticed, was formed the conclusion, that a small fragment broken from a loadstone, might possess as great power as the whole mass; and that, in some cases, the power of the fragment was actually greater than the mass from which it was taken. With regard to the truth or falsehood of this hypothesis, or to the existence of the specimens upon the powers of which it is built, I do not at present mean to offer any remark.

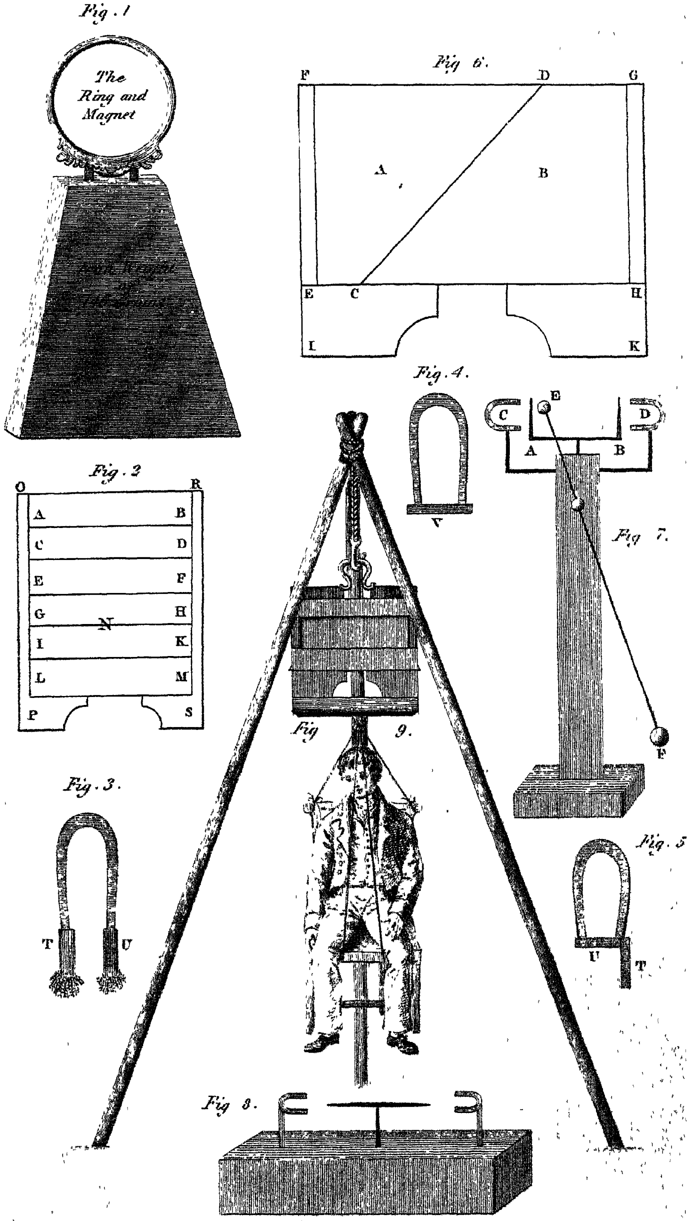


Fig. 1
The Ring and Magnet
Fig. 6.
F D G
A B
E C H
I K
Fig. 2
O R
A B
C D
E F
G H
N
I K
L M
P S
Fig. 4.
V
E
C D
A B
Fig. 7.
F
Fig 9.
Fig. 3.
T U
Fig. 5
U T
Fig 8.

It is a fact well known, that large masses of this mineral often have a weak power, and that small specimens generally have a stronger proportional energy. We have an example of this in the account given of the large specimen in the Leverean Museum, which is stated to have a very weak power; and the three small specimens noticed by Mr MARTIN, which presented a very great power. One of these belonged to Mr HAAC; it weighed 14½ ounces when armed, and carried 16 times its own weight. Another belonged to the Honourable Mr BERKELEY, then at Bruton; it weighed 43 grains when armed, and carried 1032 grains, being 24 times its own weight. And the third, which Mr NEWTON wore in a ring, weighed scarce 3 grains, it took up 746 grains, being 250 times its own weight. (See Plate XII. fig. 1.) In these three small specimens we find the power of attraction to be comparatively greatest the smaller their size is. Mr NEWTON's carried no less than 250 times its weight, whereas Mr BERKELEY's only carried 24 times, and Mr HAAC's only 16 times, their respective weights.

Such being the general character of natural magnets, with regard to the comparative attractive power of small and large ones, it is of some importance to notice three large loadstones, which arrived here a few years ago, and were purchased by Mr SANDERSON, lapidary in this city. These form an exception so far to the above conclusions. No public notice has yet been taken of these natural productions; and as two of them remained for ten months in my possession, and presented several peculiarities, I now take the liberty to notice them to the Society.

They are said to have been removed from Moscow, when the French were advancing towards that city, previous to its being burnt; they were then conveyed to Petersburgh, and from thence shipped to this country. They were cased

with an iron armature; and when they came into Mr Sanderson's possession, were supposed to have but a very trifling magnetic power. A report of the great size of these loadstones was very rapidly circulated, and many gentlemen called to examine them, who generally evinced their surprise that so little attractive power was displayed; but it is rather extraordinary that none of them traced out the cause, which we can only attribute to the rusty state in which the magnets were at the time: be this, however, the case or not, there can be little doubt that the full energy of these valuable minerals might still have remained latent, as they were for some time laid by as nearly useless, had not Mr Sanderson thought of cleaning them, to see what effect that might have. For which purpose, the iron armature was removed; and this was scarcely done, when the cause of the inactivity was found to have rested in the armature, for the unarmed loadstone now lifted pieces of iron. They were thereafter armed with copper and brass, and began to exhibit an increasing power, as additional weights were added to them.

It may appear, at first view of the circumstance, that the person who armed these magnets with iron, displayed little knowledge of magnetism; but upon considering it more maturely, we will form an opposite opinion. Let us for a moment trace the effect of such an armature. The two surfaces, upon which the artificial poles are placed, present innumerable magnetic points, or so far combined poles, —and soft iron has the power of receiving and conveying these to a focus, as it were. Now, suppose N (see fig. 2.) to be a magnet, and the lines OP and RS its two polar surfaces; if we put a slip of soft iron round the portion marked AB, then that soft iron receives the magnetism of all the polar surface which it covers, and conveys it round in a circle, and will thus take away so much of the

full energy of N: if we now put another strip of soft iron round CD of the magnet, we in the same way cut off from action another portion of the magnetic surface of N: and if we proceed to add more strips of iron, as EF, GH, IK, and LM, we gradually weaken the effective power of N, till we nearly prevent it altogether. This might be illustrated by numerous experiments. Let us select one. Let us apply to the poles of a horse-shoe magnet (as shewn in Pl. XII. fig. 3.) two such pieces of soft iron as are usually employed to connect the two kinds of magnetism (T and U), and leaving them in contact with iron-filings, and they will be attracted to T and U in great abundance: now place a similar piece of soft iron (see fig. 4.) on both poles, and V will not attract iron-filings, for the magnetic circle is complete. If, again, we place the pieces of soft iron, T and U, as shewn in fig. 5, then T will shew scarcely any power of attraction; but if we draw away U, the attraction of T becomes powerful, and is again lost when we return U to its situation. From all these facts, then, it would appear, that, when we complete the magnetic circle, we prevent considerably the escape of the attracting power, or rather, I should say, we retain the acquired activity of the magnet. And it was most likely for this purpose that these magnets were covered with an iron armature.

The largest of the loadstones, independent of its armature and connecting iron, weighs $125\frac{1}{4}$ pounds; and it measures,

In length, - - - - - -	$10\frac{3}{4}$ inches,
— breadth, - - - - - -	$8\frac{1}{2}$
— height, - - - - - -	$9\frac{1}{2}$

When I received it, it could carry 163 pounds; but, by gradually increasing the weight, I afterwards brought it to support 165 pounds, exclusive of a connecting iron of

about 28 pounds, and the ropes and pullies, which might be 12 pounds more, making in all 205 pounds; thus giving an improved power equal to 42 pounds. This loadstone is now in the possession of Dr Hope, Professor of Chemistry, in this city, and is the most powerful one of its size of which we have any recorded account. And it must be gratifying to know, that this valuable specimen is not to be lost to science, as it might have been, had it fallen into the possession of a private collector; but that Dr Hope, with his usual liberality, means it to form an addition to the invaluable collection of minerals in the Museum of the Edinburgh University.

The weight of the second loadstone, independent of its armature and connecting iron, is $28\frac{1}{4}$ pounds; it measures,

In length,	- - - -	$5\frac{1}{8}$ inches,
— breadth,	- - - -	4
— height,	- - - -	8

On the 28th November 1818, I had suspended from it a mass of calcedony weighing 80 pounds, to which is to be added the weight of the connecting iron and ropes, which is $5\frac{1}{2}$ pounds. This loadstone is still in the possession of Mr Sanderson.

The third of these minerals I have never seen, but I understand its size and power are intermediate between the two first. It is now the property of Gilbert Innes, Esq. of Stowe.

These natural magnets came to this country in the same vessel; and during their passage, the two first mentioned had been placed beside each other with their improper poles in contact, by means of which, the weaker one had its poles changed, the north being converted into a south, and the south into a north pole.

A curious circumstance, which I found to be exhibited by the largest of these three loadstones, deserves particular notice. The full energy of the south pole was not displayed at E (see Plate XII. fig. 6.), nor did it run along the line EF, as is usual; but it was strongest at C, more than an inch from the proper situation of the south pole of the mass, and the force of the south attraction ran along the line CD. The north pole, however, was quite correct, being most powerful at H, and along the line HG. It may be proper here to notice, that these lines of attraction were ascertained by means of a small pocket-compass, about one inch in length, which was very delicate, and most sensibly affected by the slightest changes from the lines of attraction just mentioned. In case the peculiar situation of the loadstone might have any effect, the position was changed in various trials, and the same results always accompanied the application of the small compass. The experiment was again repeated, to discover what effect an attached weight might have on the result, when it was invariably found, that weights of different sizes, such as 20, 40, 60, 80, 100, 150, and even 205 pounds, had no influence in altering the line of south attraction along CD. Such, then, is the fact with regard to the south pole of this loadstone, and we are naturally led to trace some cause for so unusual an appearance. It may arise from one of three circumstances:

1*st*, The part A, cut off by the line of south attraction CD, may be a mass of ironstone unmagnetic, which, of course, by its presence, may not much affect the full force of attraction at the artificial south pole.

2*dly*, The part A, may be an ironstone-paste, added by art, for the purpose of completing the shape of the loadstone,—as is generally done, in smaller quantities, when

slight irregularities occur in shaping the natural stone. The presence of this paste may not weaken the magnetic force of B obtained at the connecting poles. Or,

3dly, A, may be a distinct loadstone, of a smaller size, and probably a very weak one, in comparison with B, but still possessing the full characters of a complete magnet; in which case, it must have a tendency so far to weaken the power of B. From its magnetic energy being less, A cannot change the poles of B, nor alter the line of its attraction, but it may probably weaken them:—on the other hand, B, possessing the stronger power, will alter the poles of A, so as to correspond with its own; that is to say, the part of A immediately in contact with C, will be converted into a north pole, and the part at E will be converted into a south pole. From this, it follows, that when the different weights noticed are attracted by the artificial poles I K, they are not sustained there solely by the energy of B; but by the strong north pole of B, and the weak south pole of A, to which last may very likely be added a minute portion of south attraction conveyed through A from C to E; but this quantity must be very small, from the combined effects of the attraction at C, and the repulsion at E, for south magnetism. Thus, the artificial pole I will not keep up a corresponding strength with K; and this appears verified by experiment, for the small compass was found not to be attracted so powerfully by one-half at E as at H, or at I as at K, nor at C as at H, for the whole south situations seemed to be weakened in their power. From the external appearance also of the loadstone, on both sides of the line of extreme south attraction C D, this third seems the more probable nature of A. If we allow this to be the case, then, by removing A, we must greatly add to the quantity of magnetic effect displayed at the two poles;

but as a loadstone is very apt to be injured by being struck forcibly, it might be hazardous to make the trial.

Before concluding this paper, I may take notice of an imposition which was, about three years ago, attempted to be kept up upon the prosecutors of science in different parts of the united kingdoms by a needy shoemaker, as this disgraceful fraud was first exposed by means of the largest of the magnets just explained. This individual pretended he had discovered a black substance which did not conduct magnetic energy through it, and he wished it to appear, that when this substance was made to come between a steel beam and a magnet, the power of attraction was at least lessened, if not altogether stopped. He placed machinery in such a situation as not to be observed, and, with the assistance of a few falsehoods, which he found very useful in raising the curiosity and extorting the charity of credulous visitors, he tried to induce a belief that a pendulum was then moving a clock, and had continued to do so for six months, without any other exciting power than two small magnets. This is shewn in fig. 7. A B are the two supposed non-conductors of magnetism, affixed to the opposite ends of a beam moving on its centre; C D are the two magnets, which were said to attract alternately the end E of the pendulum EF. At the commencement of the motion of the pendulum, it was said that one of the pieces of the black substance, say A, was moved from between the magnet C and the pendulum; this enabled the attraction between C E to take place, and cut off the attraction between D E; and this is the state in which the figure on the plate is drawn. But as E approaches nearer to C, so as to present the actual contact of C E, then A moves up, and entirely cuts off the effect, and at the same time B leaves the power of D in full action; therefore E

moves from C towards D, and, when it has nearly arrived there, B again moves up, and A descends: and thus, it was maintained, the continued motion of the pendulum was kept up.

Another way of exhibiting this deception is shewn in fig. 8. Here, by the false account given, we are told, that a very fine steel beam, about an inch in length, has been made to revolve with great rapidity for many months, and that two magnets, partially coated with the extraordinary black substance already noticed, and placed at opposite sides, are the sole cause of the motion. This motion, it is almost unnecessary to add, was also induced by secreted machinery in the box on which it rested. On one of the nights of lecture, when I was upon the subject of magnetism, this scientific juggler brought his perpetual motion, as he called it, to the class-room. As at this time I had the largest of the three magnets (fig. 9.) suspended there, for the purpose of explaining its peculiarities and powers, I thought it would be a good opportunity to try the truth of his assertion with regard to the cause of the motion. I therefore placed the revolving needle (fig. 8.) on a table under the large magnet, while the usual weight which it carried was removed, but the needle moved as rapidly as before. Here, then, a loadstone, capable of lifting 205 pounds, did not affect a needle, said to be moved by two very small artificial horse-shoe magnets.—On another occasion, I placed a piece of the black substance, which was called a non-conductor, between a magnet and a magnetised sewing-needle, which I balanced on the point of my finger, and I found it to be attracted and repelled, as the different poles were presented, in the same way as if no such black substance had intervened.

Explanation of Plate XII.

Fig. 1. Represents the original size of Mr Newton's magnetic ring, and the weight attached to it. See page 387.

2. A magnet, surrounded by slips of iron AB, CD, EF, GH, IK, and LM, described p. 388-9.

3. 4. & 5. Horse-shoe magnets, with flat bars of soft iron, T, U, and V, attached to them, to shew the effect of completing and breaking off the magnetic circle; see p. 389.

6. Dr Hope's large magnet, shewing its unusual line of attraction CD; p. 391.

7. The pretended pendulum-motion by magnetism, p. 393.

8. The pretended perpetual magnetic motion, p. 394.

9. Represents Dr Hope's large magnet, as it was suspended in Mr Deuchar's class-room, for the purpose of allowing the pupils attending to try its great power.

XXX.—*Recollections of a Journey from Kandy to Caltura, by the way of Adam's Peak, made in the Year* 1819,

By SIMON SAWERS, Esq.
Commissioner of Revenue in the Kandyan Provinces,

AND

Mr HENRY MARSHALL, Surgeon to the Forces, and Author of a Work on the Medical Topography and Diseases of the Interior of Ceylon.

(*Communicated by* Mr MARSHALL, *and read 28th December* 1822.)

From Kandy to Gampoola, 15 *miles*

1819, *March* 29.—ABOUT 6 A. M., Mr Sawers was waited upon by an astrologer, for the purpose of announcing to him that the lucky period for beginning his journey had arrived. The astrologers in the Kandyan country are generally weavers, or tom-tom beaters (drummers). They calculate eclipses, and profess to predict "good days and good seasons." The King of Kandy never commenced a journey, or any work of importance, without previously consulting an astrologer. Lands were held by the King's astrologer as a remuneration for the performance of his duties.

We left Kandy about 7 A. M. The road to Gampoola crosses the Maha Villa Ganga at the ford of Mee Watera, about one mile above the Gan-Orua ferry, and leads southward along the left bank of the river. On each side of the river a broken ridge of mountains rises, which slopes abruptly to the edge of the current. The pathway passes through thick jungle, and seldom deviates to any considerable extent from the side of the river.

In consequence of the abrupt sloping of the hills towards the river, there is very little ground fit for the cultivation of paddy (rice) on either of its banks. For the first six or seven miles there are, at distant intervals, small level spaces where paddy is raised, on the right bank of the river. On the left bank, however, there is no ground fit for its cultivation, until within a few miles of Gampoola. As we approach this station, the mountains on the left of the river diverge, leaving a valley of about a mile broad between them and the river. This is the Valley of Gampoola.

The mountains and hills which bounded the view from the pathway, were, for the most part, thickly covered with jungle, and had a sombre autumnal appearance.

We reached Gampoola about 1 P. M. The vale of Gampoola is well watered, and yields two crops annually. The seasons of sowing depend greatly upon the state of the weather in regard to rain. Fields that can be irrigated from a river or constant stream, may be sown during any period of the year, and many spots of ground thus situated yield three crops a-year. There are two kinds of paddy much raised in the Kandyan provinces, namely, the Maha Wee, and Hinettee or Sinnettee. The former yields the best crop, but it requires from six to seven months to arrive at maturity; the latter is sooner ripe, but the crop is less abundant. The Maha Wee is sown in July or August, and is generally reaped in February or

March; whereas the Hinettee is sown in September and October, and reaped in January and February. When the paddy is reaped, it is immediately carried to the Komutah, or thrashing-floor, which is an elevated spot, of a circular form, made perfectly smooth and even, and is generally at the edge or very near to the border of the paddy-field. The grain is trodden from the straw by means of buffaloes, and occasionally by men.

At the limits of each district Mr Sawers was met by the disauve, or native chief, of the province, who, for the most part, accompanied him through his disauvony. On occasions of this kind, the chiefs bring along with them a number of flags, together with tom-toms, wind-instruments, and a large retinue of followers. The flags of each province have particular devices painted upon them, generally the figures of some animals. Mr Sawers was always accompanied by the musical train of one district until he reached the confines of another. The chiefs sent great quantities of ready dressed rice for Mr Sawers' followers. When the disauves, and native chiefs of less note, travel through the country, the inhabitants of the different villages must furnish them with whatever food they require, both for themselves and their followers; the former with uncooked, the latter with ready-dressed victuals.

Gampoola is a royal village. It was formerly the capital of the kings of the Udda Rata (upper country). It is said that the last king, who resided at Gampoola, one day pursued a hare, and that she ran to the place where the king's bed-room was afterwards built, in Kandy (the present Treasury). This being considered a favourable omen, the king immediately fixed upon Kandy for his future residence. All religious processions proceed from this spot, or from the Nata Dewala, they being considered very holy.

There was a small military detachment at Gampoola. We slept in a temporary building, which had been constructed for Mr SAWERS' accommodation. Except the huts for the troops, there are no houses in Gampoola. The habitations of the natives were situated on the margin of the valley; but being enveloped in thick topes or copses, the houses could not be seen.

March 30.—From Gampoola to Ambegamme, distance probably about 14 miles.

We left Gampoola about 6 A. M., accompanied by all the drums and squeaking trumpets the district could afford. The pathway lay very near to the margin of the Maha Villa Ganga, and skirted the hills which sloped to its left bank. At Pasbage, which is about half way to Ambegamme, the Kotmale river is joined by the Pasbage river, and these form the Maha Villa Ganga. The Kotmale river sometimes obtains the name of Maha Villa Ganga before the junction. Our route lay along the left bank of the Pasbage river. Near to Pasbage, we had a distant view of Adam's Peak; it bore SSW. from us. The hills that we passed to-day were less densely covered with jungle than those which bounded our view yesterday. The ravines and hollows upon the declivities of the hills were in general thickly overgrown with trees and underwood, but the ridges and lower swells were covered with tall lemon-grass. On many occasions it was difficult to account for the marginated and distinct patches of trees and jungle. In general, the trees were most abundant where they seemed to have a chance of being well watered. The tops of the hills were more frequently covered with trees than the ridges upon the declivities. Perhaps this is owing to the summits of the mountains being more frequently in contact with clouds than the lower inequalities.

The lemon-grass is burned annually by the natives. The young shoots which spring up after this operation are much relished by cattle. It is for the purpose of affording a rich and tender pasture that the old lemon-grass is consumed.

We saw very little ground under cultivation during this day's journey; indeed there was very little level surface on either side of the pathway, which would admit of being cultivated. Most of the small paddy-fields which we passed during this day, appeared to have been originally merely water-courses, that had been enlarged by human labour. By cutting away a portion of the sloping part of the hill on each side of the rivulet, and depositing the earth in the centre of the ravine, a small flat is formed, which becomes easily irrigated from the water-course that is made to run along one of its sides.

At the upper corner of these small triangular fields, we sometimes saw an apparently snug little cottage thatched with straw, and half hidden from view by the trees which surrounded it. The Kandyan cottages are in general deeply embowered in trees and low jungle. At a distance, the residence of a Kandyan is discovered by the nature of the trees and shrubs that grow around his dwelling. These are chiefly the broad-leaved talipot, the tall coco-nut, the erect and stately jagery tree, the elegant and slender areca, the dark-green-leaved jack, the luxuriant plantain, and the silvery glistening kokun-gaha.

Within about a mile of Ambegamme, there is, at the right side of the pathway, a large fragment of rock, nearly covered with inscriptions, in a character unknown to the natives of the country.

Ambegamme lies on the right bank of the Pasbage river, and close to a ford which we crossed. There are only two

or three huts here, which the inhabitants had deserted. We occupied one of them during the night.

March 31.—From Ambegamme to Wella Malloo, 5½ hours on the road; probable distance about 10 miles.

At 6 A. M. we left Ambegamme. For about a quarter of a mile the pathway leads along the right bank of the river, and then crosses to the left by a ford. From this ford the road led along the bed of a very rugged ravine to the top of a high hill. After gaining the summit, we had to descend the hill, on the other side, by a still more rugged and precipitous ravine than the one in which we had ascended. In wet weather, these ravines contain mountain-torrents, which sweep away the earth and small stones, leaving only the large masses of rock. The pathway is therefore extremely rugged, and the labour which attends the ascending or descending is very considerable. The large roots of trees which cross the ravines, form as serious impediments as the rocky masses that are found lying along their course. The flanks of the ravines were overgrown with trees of all ages; some were merely young shoots; others in a state of maturity, and of enormous magnitude, while many were in a state of great decay. We were nearly two hours in traversing this hill. At the bottom of the hill we crossed the Kihel-gamme-ganga (plantain-village-river), which runs westward. In wet weather this river must be very large and rapid, and cannot then be passed. We were here informed that no European had ever proceeded farther by this route.

About an hour after crossing the Kihel-gamme-ganga, we reached the Maskilia-ganga. Both these rivers run in the same direction. Eventually they unite, and contribute to form the Calany-ganga, or Moot-waal river, which falls into the sea near to Colombo. Hitherto we had travelled

in a direction nearly south-west: the route now lay nearly east-south-east.

Shortly after crossing the Maskilia-ganga, the country became a little more open. On each side of the pathway there was a range of high hills; that on our right was much broken, remarkably rugged, and peaked. Many of the peaks were composed of masses of granitic rock, with scarcely enough of soil upon them to support vegetation. The range on the left was more distant, and less broken, than that on the right.

The entire face of the country through which we travelled to-day was covered with forest-trees and low jungle. We did not observe a single paddy-field, or even a spot of ground capable of being cultivated with that grain. At very distant intervals we saw marks of the cultivation of natchenny (*Cynosurus Carrocanus*) on the acclivities of the adjoining hills, which seemed more to display the density of the mountain-forest, than to relieve the sameness of the prospect of interminable woods.

Far elevated upon the sides of the neighbouring hills we sometimes remarked a hut. A few jagery-trees (*Caryota urens*) generally grew close adjoining to the huts. On inquiry, we learned that the inhabitants of these alpine abodes constructed their huts upon spots of difficult access, in the hopes of thereby escaping the ravages of wild elephants. These animals spread complete ruin and devastation when they enter a field under crop. Their strength enables them to destroy even fruit-trees, which they do by pushing them over, and feeding upon the branches. They are particularly fond of the leaves of the jagery-palm. Elephants have an astonishing sagacity in discovering deposits of grain. Nothing can prevent their plundering the grain when it is once discovered. The mud-huts of the natives are too frail to present an impediment of any consequence. To gain his

end, an elephant will demolish a cottage in the course of a few minutes, by pushing the walls over with his trunk. During these periods of depredation it is dangerous for any person to come near them. Few of the natives of this part of the country attempt to keep black cattle or buffaloes, on account of the great number of chitahs, which destroys many of the young calves. Bears are here numerous, and prove a source of great annoyance to the inhabitants.

These highland cottagers subsist chiefly by drawing toddy from the kettule or jagery tree, and extracting from it hackaroor, or jagery, which is a coarse kind of sugar. This tree grows here in a wild state, and I could not discover that the people ever cultivated it. When a cluster of fruit bearing jagery-palms is discovered, one of the natives constructs a hut in the neighbourhood, and there resides while the product is abundant.

Jagery is the chief food of these people; occasionally, although but rarely, they raise a little natcheny. Rice is a luxury they scarcely ever enjoy. They dispose of a little jagery, and thereby procure by barter a piece of cloth to wrap round their loins, and the small portion of salt they require. They seem to have no other wants.

It was on the sides of these rugged hills that we first saw the plantain-tree in a state of nature. When uncultivated, the fruit of this plant is comparatively small. It contains a great many seeds, and has but little pulpy matter. At Welle-malloo, where we halted, there is a little hut, which stands on the bank of a small river, and is situated immediately below an abrupt and acutely peaked mountain, formed of an immense mass of granite. On the top of the mountain there was some vegetation, but the precipitous front, which looked towards the hut, was a bare frowning black rock. Here the mercury of the thermometer rose in our tent to 100°. In a hut made of the

leaves of the coco-nut tree, the temperature was only 90°.

During all this day's journey, the road was extremely rocky and rugged.

April 1.—*From Welle-malloo to Doonatiboo-oya*, 7½ hours; probable distance about 12 miles.

We left Welle-malloo about half-past 6 A. M. From this station none of the native chiefs accompanied us. For about a mile and a half the pathway was very rugged; still, however, a track was evident. To this distance the road had been opened, by cutting down the jungle which grew upon it. In many places the pathway became now so overgrown with succulent plants and jungle, that the guides found it often difficult to trace the route. Sometimes we could not perceive an object before us above the distance of a few yards, so completely were we enveloped in thick jungle. This overgrown state of the pathway retarded our progress greatly.

During the native government, it was customary for a number of the inhabitants of the interior of the island to go every year by this route on a pilgrimage to the Peak. The chiefs were particularly attentive to this act of devotion; and as they always travelled with a great retinue, it was the business of part of their attendants to clear the pathway of the jungle and young trees. These pilgrimages have nearly ceased, since the English occupied the country. In the month of February 1817, two chiefs, with about two hundred followers, went from Kandy by this way to the Peak; but since that period it was supposed not a human being had passed by this road. Hence the extremely overgrown condition of the pathway.

During this day's journey there was a considerable degree of ascent in the road. The trees began to be covered with moss, or lichen, and to show other signs, that the

situation in which they grew was much elevated above the site of Kandy. For some time the pathway lay along the ridge of a narrow hill, on each side of which was a river, or oya. Beyond each river was a range of peaked mountains; that on our right was remarkably high and rugged. The rivers at some places fell over stupendous precipices, forming cascades of great magnitude. From the height of one of these cascades, the whole mass of water, which passed over the rock, seemed to rise again in white vapour.—Before reaching Doonatiboo-Oya, we ascended the Heremetya-hela (Walking-stick Hill). The pathway is here excessively steep. Formerly, when the number of pilgrims who visited the Peak by this route was numerous, it was considered meritorious for each pilgrim to dispose of his walking-staff on the face of the hill, so as to assist future travellers in effecting an ascent. For this purpose, some of the walking-sticks are pushed perpendicularly into the earth about a foot and a half, or two feet, distant. Behind these vertical sticks, bundles of rods are laid horizontally, by which means steps are formed that greatly assist in ascending the steep face of the hill. We did not see a single cottage during this day's journey. The guides which Mr Sawers had procured at Welle-malloo, asserted they were ignorant of the road shortly after they left that place; they, however, penetrated into the jungle, and discovered a hut, the proprietor of which they brought away with them, and insisted that he should act as a guide. This man stated that he had been sixteen times at the Peak, but he evinced great reluctance to revisit it on this occasion. His scruples were eventually removed, and he afterwards proved to be very useful. Although the constant inhabitant of a dreary inhospitable wilderness, he conducted himself with much propriety, I may even say politeness, and evinced intellectual qualities far beyond our expectation.

We halted at Doonatiboo-oya, on a small spot of ground which had been cleared of jungle, for the accommodation of pilgrims.

April 2.—From Doonatiboo-oya to Gangaloo-oya; 4 hours, probable distance about 6 miles.

We left Doonatiboo-oya at half past 6 A. M. The pathway was, if possible, more rugged than any part of the road we had already passed. The guides were frequently at a loss to distinguish the tracks of elephants through the jungle, from the path which we ought to follow. In some places it was greatly obstructed by extremely tall ferns. The chief part of our journey this day lay across a very high hill. The trees were now comparatively stunted, much covered with moss, and the leaves coriaceous. On reaching the top of the hill we had a near view of the Peak. The descent to the Gangaloo-oya, which runs at the bottom of the hill, was uncommonly rugged.

We encamped on the left bank of the Gangaloo-oya, upon a spot of ground which had been cleared for the accommodation of pilgrims. Immediately from the opposite bank of the river, the Peak rose abruptly like an immense acuminated dome. It was completely covered with jungle, except in some spots near to the top, where the naked precipitous rock protruded. On the right of our encampment there was a very high mountain, seemingly formed of an enormous mass of granitic rock, uncovered in many places with soil or vegetation.

April 3.—From Gangaloo to the top of the Peak.

We left our ground this morning at a quarter past 7 A. M. For a short way our route led up the left bank of the Oya; it then crossed to the right bank. Upon reaching the Oya, our native attendants commenced the ceremonies of ablu-

tion, preparatory to the delivery of their *poojah*, or offering at the shrine of the *Sri pade*, or impression of the holy foot. The offerings were of various kinds; in general, they consisted of a few small copper-coins. These the devotees wrapped in a piece of cloth, which they put into a handkerchief that encircled their head; it being requisite that the offering should be borne on the head. After leaving the river, the pathway led up a deep narrow rugged ravine, which, in wet weather, must be the bed of a mountain-torrent, and consequently then impassable. Thick jungle and large trees grew close to the edge of the ravine, by which means the view was greatly intercepted. As we approached the top of the mountain, the altitude of the trees diminished, the shade was less dense, and the prospect more open. When we had reached about two-thirds of the ascent, our followers informed us that they had arrived at the place where needles and threads are usually offered to Buddhoo. The offering is laid upon a small rock, which stands on the right of the road. The Buddhists, among our followers, had been very improvident in regard to an oblation of needles, &c.; only one needle and thread were found among the whole party. As soon, however, as one Buddhist deposited the needle and thread upon the rock, they were seized and replaced in the same manner by another.

During the course of the journey, when our followers saw the *Mallua Sri Pade* (the Hill of the Holy Foot, or Holy Impression), they raised their joined hands over the head, and, in a kind of holy fervour, called out *Sāā-Sāā*. Their zeal in this respect increased greatly as we approached the end of our journey. The superior portion of the Peak consists of an immense cone of granitic rock, which is in general but very partially covered with vegetation. The track over several places of this cone is abrupt; and

where the pathway leads over a bare declivous rock, there are steps cut in the stone, and chains so fixed as to lie along the steps, for the purpose of assisting passengers in ascending and descending.

About a quarter past 9 o'clock we reached the top of the Peak. Here we found about forty or fifty pilgrims, who had ascended by the Saffragam or western route. They were busily employed in the performance of the usual ceremonies, and our arrival did not appear to disconcert them in the slightest degree. Upon the completion of the customary ritual, they abruptly departed, and descended the mountain, without seeming to look to the right or left.

The apex is surrounded by a wall, in which there are two distinct openings, corresponding to the two tracks by which the mountain can be ascended, one by the route we came, and another from the district of Saffragam. The area included within the wall is about 23 paces long by 18 broad. Nearly in the centre of the area there is a large rock, one side of which is shelving, and can be easily ascended. On the top of this mass of granite there is a small square wooden shed, which is connected with the rock, as also with the outer wall, by means of heavy chains. The roof and posts of this little building we found adorned with flowers and artificial figures made of party-coloured cloth. The use of the shed is to cover the *Sri pade* (Holy Foot). This impression has been in part formed by the chisel, and partly by elevating its outer border with chunam (lime). In length it is about 5½ feet long, and in breadth about 2½ feet. The depth is irregular, and varies from about 1½ to 2 inches. Much of the margin of the impression, and all the elevations which mark the spaces between the toes, are made of lime and sand. A border of gilded copper, in which a few valueless gems are set, encircles the impression. According to the

books respecting Buddhoo, it appears that he stepped from the top of the Peak to the kingdom of Siam. The Buddhists profess to believe the impression is a mark made by the last foot of Buddhoo which left Ceylon. But so little did the contrivers of the fable know of geography, that even the direction of the impression is destructive of the credibility of the story regarding the stepping of Buddhoo from Ceylon to Siam. From heel to toe, the direction of the impression is NW. by W., while Siam lies very differently from Ceylon. It seems to have been intended that the mark in the rock should resemble the impression of the left foot.

From the time we resolved upon visiting the *Sri pade*, it was our intention to remain for a night on the top of the Peak. We found some difficulty in carrying this intention into effect. Our servants and followers anxiously requested us to change the resolution we had formed. They pleaded want of accommodation and extreme cold, as excuses for wishing to abandon the top of the mountain as soon as possible. These were only pretences; the real cause of their reluctance to remain on the Peak may be attributed to the superstitious awe and dread with which they are impressed when near to places held sacred by the tenets of Buddhism.

Immediately upon our reaching the top of the mountain, the chief priest waited upon us, and affected to be much concerned respecting our welfare. He asked us whether we intended to remain there all night, and was answered in the affirmative. He then most earnestly begged that we should alter our determination. Disease, he said, would be the inevitable consequence of our remaining on the Peak during night. He told us only one white man had ever slept there, and that he sickened soon after. By what motives the priest was actuated, when he entreated us so earnestly to leave the Peak, it is difficult to conjecture. When he

found, however, that his arguments were not likely to avail much, he disappeared. In a short time he returned, bringing with him a number of plants, a portion of which he gave to each of us. He took great pains to impress us with a belief in the potency of their virtues, and informed us, that, by wearing a part of one of them as an amulet, we should be protected from the injurious attacks of bears. In like manner, some were calculated to protect us from elephants; and others from devils, sickness, &c. One herb he asserted would prevent misfortune, sickness, and evils of every kind *.

* It is not improbable that the priest did really entertain fears that we should become sick, by remaining all night in the vicinity of a place which is held remarkable for holiness, and that he considered the amulets, with which he provided us, necessary for our protection. The Buddhists themselves approach celebrated temples and depositaries of the relics of Buddhoo with a veneration mixed with terror, and seem always apprehensive that some evil may happen to them. Europeans are not considered to be favourites of the oriental divinities; and it is the universal opinion of the Kandyans, that misfortune and disease owe their origin to the vengeance of good or bad spirits. Before the Captivity, the Jews held opinions, in this respect, not very different from the Kandyans. With the view of averting disease, and any national calamity, the Jews made expiatory sacrifices, which consisted of both animal and vegetable substances; and for a similar purpose, the Kandyans devote a portion of their ordinary food (rice) as a means of assuaging the wrath of a malignant spirit. Sometimes, however, during disease, they promise to present some article of value to a particular Vihary (temple), in the event of recovery. I have known the figure of an eye, in silver, placed under the keeping of the priests of a temple, upon recovery from an attack of ophthalmia. The means of propitiation adopted by the Philistines, as recorded in 1 Samuel, chap. vi., resembles that of the inhabitants of Ceylon. In ancient times, a similar practice obtained in the Greek temples. SPRENGEL, in his History of Medicine, informs us, that it was customary for individuals labouring under disease, to resort to certain places that were deemed sacred, in the hope of recovery; and adds,

Not having room to pitch our tent, we occupied a small hut of about six feet square, which stands close to the rock that rises within the area.

During the day, small parties of pilgrims occasionally reached the top of the Peak. The pilgrims appeared to be chiefly inhabitants of the maritime provinces. Many of the parties consisted of individuals of all ages; some were mere children, while others had become decrepit from old age.

The pilgrims seemed to ascend the Peak in parties. As soon as a party entered the area within the wall, the individuals immediately approached the rock in the centre, and gradually ascended to the *Sri pade*. The pilgrims do not go under the shed; they stand close to that end of the impression which is intended to mark the toes. Here they make a number of profound *salāāms*, by putting the palms of the hands together, and holding them before the face, or raising them above the head. While thus employed, they appear to be muttering some words. Each individual then presents his offering, which is deposited in the sacred impression. The presents consist of copper-money, rice, coco-nuts, cotton-cloth, handkerchiefs, betel-leaves, flowers, onions, ornaments for the shed which covers the *Sri pade*, a lock of the hair of the head, or a portion of the beard. After depositing the offerings, the pilgrims continue for a few minutes upon the rock, making profound reverences to the holy impression. The party then descend, and form a

"Quand les malades etaient gueris, ils allaient remercier le Dieu et lui porter des offrandes. Quelquefois les malades après leur guerison faisaient modeles en ivoire, en or, argent, ou autre metal, le partie qui avait été le siege de l'affection, sorte d'offrande dont on conservait un grand nombre dans les temples."

line in the area, with their faces towards the impression. Here one of the group opens a small *book*, formed of palm-leaves, and reads, or rather chaunts, a passage from it. At the termination of each passage or stanza he is joined by the whole party, male and female, in a loud chorus, or response. The form of words used on this occasion is, I am informed, called the *Pan Sile*, or Five Commandments of Buddhoo. They are all prohibitory, and forbid,

1st, Killing any living creature.
2d, Stealing.
3d, Committing adultery.
4th, Uttering a falsehood.
5th, Drinking intoxicating liquors.

This part of the ceremonies being completed, the pilgrims proceed to one of two bells, which are suspended upon frames situated close to the central rock. Here the pilgrims individually ring one of the bells, by pulling a string attached to the clapper. They then take some strips of cloth which have been previously dipped in oil, or *ghee* (clarified butter), and light them at one end. These wicks are placed upon an iron-stand or platform, erected for the purpose, and sometimes upon the edge of a large stone.

In all the Singhalese temples, whenever offerings are made, lamps are lighted, and occasionally incense is burned. Lighted lamps, or censers, are carried before religious processions, and they used to precede the sovereign in days of state.

On a shelf of the same rock in which the *Sri pade* is cut, there is a small *deyo wahalla*. A *deyo wahalla* is a temple consecrated to Vishnoo, Natte, or some other Brahminical deity. The literal meaning of the words *deyo wahalla*, is, "House of God." Wahalle or Wassal (the *h* and *s* being used indifferently) means palace. When speaking of the king, the Kandyans used to call him *Maha Wassal*,

or Great Palace; in like manner, as the Ottoman emperor is styled the Sublime Gate.

Some of the pilgrims worship at the shrine of Vishnoo, and propitiate his good will by a small poojah, or offering. Vishnu's favour is courted for the purpose of averting from his supplicants the evils of this world, such as poverty and sickness, and that he may bestow upon his devotees happiness and prosperity. Sterile women solicit his interference, that they may become mothers; and pregnant women implore his aid in the hour of child-birth. The offerings made to Vishnoo are generally small sums of money.

The pilgrims, in general, finish the requisite ceremonies in about twelve or fifteen minutes, when they instantly proceed to the opening in the surrounding wall, and abruptly descend the cone. The Singhalese, for the most part, evince much indifference to romantic views and sublime scenery; on this occasion, their want of taste for the contemplation of natural objects is very remarkable. By far the greater number of the pilgrims never cast a look beyond the wall which surrounds the area all the time they are on the top of the mountain, from which the view is so grand and extensive.

The veneration which the inhabitants of Ceylon show to the ceremonies of Buddhoo is very surprising. Shortly after we reached the *Sri pade*, all our native followers joined the pilgrims in the ceremonies usually performed before the holy impression. The professed *Christian Catholic*, as well as the *Christian reformado*, made offerings to the *Sri pade* apparently with as much zeal as the Buddhist did. The Mussulman of Hindoostan make pilgrimages to the Peak; and, according to report, the reason they assign for visiting this mountain is, that they

believe the impression to be that of Adam, our first parent *.

The Kandyans, as well as the inhabitants of the maritime provinces, appear to consider a visit to the Peak a business of much importance. Mr SAWERS had a number of servants along with him who had never shaved. Shortly after we had entered the area of the *Sri pade*, their chins were trimmed, and the beards religiously offered at the shrine of Buddhoo; which ceremony is performed by tying the hair to the chains that are attached to the shed.

We found two priests of Buddhoo on duty at the *Sri pade;* one of them was a man far advanced in life, the other seemed to be only about twenty years of age. They reside here only during the period when pilgrims visit it, or from January to April inclusive, being the dry season, on the west side of the island. During the wet months the Peak is commonly enveloped in clouds, and in rainy weather the two pathways by which it can be ascended become impassable. The priests, while on duty at the *Sri padè*, occupy a little hut immediately without the encircling wall. The old priest informed us, that the period when he ought to leave the Peak was annually announced to him, in a dream, by a Brahmin. When he neglected the suggestion of the Brahminical phantom, a warning of a very different

* The fabulous accounts which have been given of the *Sri Mallua Pade* by the author of the Arabian Nights Entertainment, and some compilers of travels, &c. are not a little ludicrous. Sir THOMAS HERBERT, Baronet, who published an account of his travels in the "Oriental Indies and Isles adjacent," about the year 1626, tells us, that "upon Candy's high Peak was shewed and credited the footsteps of old Adam, born and buried here, if we will believe them. In the same place they shew a lake of salt water, upon a high hill, said to be no other than the tears afflicted Eve shed a hundred years together for the loss of her righteous son Abel."

kind was given to him—his clothes were devoured by rats and mice. This hint to remove was always effectual.

We did not observe the priests assist the pilgrims in their devotion. In general, however, when offerings are made to Buddhoo, a priest attends, and repeats his five precepts or commands.

The chief duty of the priests appears to be to superintend the collection and sorting of the offerings. A lay-person is appointed to receive them, but an account is kept of the receipts by the priests. At the end of the season the general amount is forwarded to the *Tirinancy*, or chief priest in Kandy. The average annual amount is about 3000 rix-dollars, or L. 250 sterling.

A little before sun-set, the old priest repaired to the Sacred Impression. He was accompanied by a boy bearing a small parcel. On reaching the side of the Impression, he made a number of profound reverences. The parcel being opened, he took from it a small bell, which he rung over the Impression, and then laid it aside: then followed a number of profound *salaams*, or reverences. He then took from the parcel a small fan, and for a considerable time waved it over the impression: this was laid aside, followed by a number of low bows. Next followed a piece of cotton-cloth, which was deposited for about a minute upon the impression, and then removed with the usual number of reverences. The priest then placed flowers upon the *Sri pade;* they were permitted to remain. Having terminated the ceremonies for the day, he returned to the hut, followed by the boy bearing the bell, fan, &c. &c.

The height of the Peak above the level of the sea has been ascertained by barometrical measurement to be about 6500 feet. From a mountain of this altitude, the view, in clear weather, must be very extensive. As far as the eye can reach, the surface of the country below appears remark-

ably unequal and rugged. Immediately in the neighbourhood of the Peak, a number of rugged and acuminated rocky projections rise to a great height. The whole country is covered with interminable forests. Here and there a frowning rock appears, covered only with grey-coloured lichen. While on the top of the mountain we could discover neither human habitations nor cultivated fields.

At the time we reached the top of the Peak, the sun was rapidly dissipating the foggy white clouds which had been precipitated upon the surface of the earth during the preceding night. The hills, and more elevated prominences of the surface, were nearly free from the white fog, but the spaces which intervened between the mountains were still densely covered with it. Our attention was soon directed to the various motions of the clouds under dissipation: being far below us, we had a very distinct view of their transitions. In some places, the white cloud seemed to lie still on the bosom of the earth; in others, the foggy vapour was in rapid motion, not only horizontally, but, in many places, vertically. While we were admiring these phenomena, a westerly wind rose, which seemed to compress, rather than dissipate, the fog. By means of this wind a large mass of white vapour was driven along the surface until it reached a transverse mountainous ridge, which overlooked a hollow space. Although the wind continued to blow, no vapour appeared to pass over the ridge:—the cloud was instantly dissipated by the high temperature of this hot basin. But what appeared most remarkable in this phenomenon, was the distinct line which marked the influence of the increased temperature of the hollow space upon the dense white fog. By about 10 o'clock A. M. the atmosphere was nearly free from clouds; during the course of the day, however, it became comparatively obscure, and the prospect more indistinct. The atmosphere above us was all

day free from clouds, and the sky a deep blue. We did not feel the heat of the sun ardent, nor was the light strong. Several times during the course of the day there were slight showers of rain, without an impending cloud. Distant objects appeared comparatively near.

Towards sun-set, the clouds which floated in the lower strata of the atmosphere became more dense than they had been during the day. The view from the Peak was now remarkably sublime, various and attractive. Our attention was strongly arrested by the rapid formation and seemingly fantastical motions of the clouds. Their transitions did not appear to be occasioned by any very general cause. This was evident by the extreme variety of their motions, and the limited extent of the atmosphere, which seemed to be influenced by one current of air.

Sometimes we saw distinct patches of white clouds lying quite still on the surface of the earth, while, in their immediate neighbourhood, other clouds were in rapid motion. A small cloud, which at first appeared like smoke rising from a chimney, would sometimes expand, and in a short time cover a hill, or large extent of surface. In a few instances we saw clouds rise from the earth in a perpendicular column, having, at the same time, a whirling or rotatory motion. When we turned our attention to another mountain, there, perhaps, we saw its top completely enveloped in a fleecy cloud, which rolled in large volumes impetuously down the upper portion of the mountain, like a tremendous cataract, sweeping every impediment before it. These vapours were instantly dissipated and dissolved in the pure atmosphere, when they reached a certain way down the mountain. There was evidently a great number of strata or currents of air in the atmosphere, which were shown by the various directions of different clouds. But, independently of the horizontal strata, there seemed to be vertical columns of clouds.

Shortly after sun-set the rapid transition of the clouds became greatly moderated. By midnight they had subsided to the lower strata of the atmosphere, and appeared to be lying on the surface of the earth. The moon shone bright, by which means we had a magnificent view of the upper surface of a dense stratum of white fleecy cloud. It is impossible to convey in words the grandeur of this scene. The surface of the earth was overspread with a covering resembling the finest white down, through which many dark-coloured mountains and cliffs projected. Could we conceive a white sea studded over with islands extremely various in size and figure, a faint idea might be entertained of the prospect from the Peak during the night.

The clouds continued to rest undisturbed on the bosom of the earth until a little after six o'clock. For some time before sun-rise, the sky towards the east had a bright flame-colour, indicative of the approach of day. The sun burst forth suddenly in all his glory: not a cloud intervened to dim his splendour. Immediately after the rising of the sun, the shadow of the Peak appeared like an immense cone or triangle standing at the edge of the western horizon. In a few minutes the base of the shadow approached the foot of the mountain. Soon after the appearance of the sun, light and floating vapours began to rise from the upper surface of the clouds, which were quickly dissolved in the superincumbent stratum of transparent air. The elevation and dissipation of the vapours increased as the sun approached the meridian.

The temperature of the air in the shade varied during day from 64° to 68°.

At 8 P. M. it was - - - -	57°
9 P. M. - - - - - - -	55½
1 A. M. - - - - - - -	53
3 A. M. - - - - - - -	51½
6 A. M. - - - - - - -	55

The temperature of the water of a spring situated a few yards without the wall was at 6 A. M. 53°. The water of this well is supposed to be a sovereign remedy in cases of sterility. Female pilgrims, who have been disappointed in regard to children, make a point of drinking from it before they leave the top of the Peak.

Immediately without the encircling wall, and for a few yards only down the declivity, there is a species of rhododendron found growing. It bears large crimson-coloured flowers, and its leaves are remarkably thick. These flowers are offered at the shrine of Buddhoo; but indeed almost every other flower which the vegetable creation produces in Ceylon is thus honoured. The priests did not object to our plucking the flowers of this tree. The limited extent of the space upon which it grows is remarkable.

From the foot of the wall, the declivity of the mountain is excessively abrupt on all sides. The upper portion of it is a large cone of granitic rock, resting upon a very high mountain belonging to the range of hills which form the rampart of the upper country.

April 4.—From Sri Pade to Palepattoola.

At about half past 6 A. M. we left the top of the Peak. The descent of the cone is much more abrupt by the route from Saffragam than by the one which we ascended. At several places the track leads over a bare, smooth, precipitous rock. The more difficult places of ascent are furnished with iron-chains, which have been put there by Buddhists, who, by charitable acts of this kind, expect to enjoy a higher state of existence after their next birth. These chains assist in ascending and descending. There are no steps cut in the rock on this side of the cone. At two or three places of the pathway, the view downwards is remarkably grand and awful. The cone at these spots seems in

some measure to overhang the lower mountain, by which means a perpendicular view is obtained to the extent of almost the entire height of the Peak. When we descended the sun shone bright upon the space where the view terminated at the bottom of the mountain, thereby greatly increasing the sublimity of the prospect. It is impossible to describe the terrific grandeur of this scene. But indeed the prospect is really so frightful, that I believe it is rarely contemplated with due composure.

The Saffragam side of the cone is nearly destitute of trees. We took about twenty-five minutes to descend the precipitous apex of the Peak. The road, or rather ravine, by which we descended was very rugged in a great number of places, and led through thick forests of very large trees.

About 11 A. M. we were met by a large band of native musicians and dancers, which had been sent by the agent of revenue in the district of Saffragam, as a mark of respect to Mr Sawers. The musical instruments were chiefly tom-toms, a species of trumpet, and a number of small bells, which were suspended round the ankles of the dancers, thereby causing a constant tinkling when they walked or danced. All the performers were clothed in a particular kind of mountebank-dress, which is worn only on occasions when they wish to make a demonstration of great joy. Immediately after we met them, they commenced their performances, which consisted in making all the noise they were able, with drums, bells, and trumpets, the clangour of which, although sufficiently loud, was less clamorous than the singing and shouting of the vocal performers. They preceded us in the pathway, and continued their music and vociferation until we arrived at Palepattoola. Having obtained a copy of one of their songs, in the

Pali language, I subjoin a translation, by Mr ARMOUR, interpreter to the judicial commissioner in Kandy *.

We halted on the road about an hour, and reached Palepattoola at 2 P. M.

April 5.—*From Palepattoola to Ratnapore*, distance about 12 miles.

1.

* Having divested himself of fear for personal safety, and of anxiety for his wealth, through loyalty to the European Potentate, *Ekneligoda Dessave*, with undaunted courage and resolution, Prosperity perched on his shoulders, and, followed by armed bands, went forth against the rebel multitude, and, like the bird *Garooda*, destroyed the insurgent serpents.

2.

Possessed of courage, and gifted with victory, as were the mighty heroes *Ramah Arguna*, *Vasoo Deva*, and *Beema Lena*, and bounteous as the *Kalpa Wurksha*, did not he, the great *Ekneligoda*, rush forward, and extinguish rebellion throughout *Orwah*?

3.

He having received the approbation of the great B——, the English Commander accompanied the troops with a powerful host of Saffragam people, pursued and hanged the rebels on trees, thereby stunning them with terror and dismay.

4.

The archers, in their ambuscades, laid their hand on the bow-string, but before they could discharge their arrows, they were stultified with fear, and underwent severe chastisement. Why have ye forgotten all which brave *Ekneligoda* accomplished?

Ekneligoda is Dessave, or first native chief, in the province of Saffragam. He was the only Kandyan of rank who seemed to take an active part, in aid of the English troops, to subdue his countrymen, in 1817 and 1818. Protected by the troops, the Saffragam host did certainly excite terror and dismay among the inhabitants, by spreading over the country, and plundering whatever came in their way. Nothing was too insignificant for their excessive cupidity.

Palepattoola is a rest-house or caravansary, situate at the bottom of the Peak, for the accommodation of pilgrims. We left this place about half past 5 A. M. During the early part of this day's journey, the road was remarkably rugged, and passed through woods of tall trees and thick jungle. As we approached Ratnapore, the prospect became more open. The country was now comparatively level, and some marks of cultivation were perceived. We reached Ratnapore about 10 A. M. Here we halted until about 5 P. M., and then embarked in a boat on the Calloo Ganga (Caltura River), and at 2 P. M. next day we reached Caltura, a station situate at the estuary of the river.

We left Kandy in the hope that the road would permit of our being carried in chairs great part of the way. After reaching Ambegamme, however, the road became too narrow and rugged to admit of this mode of conveyance. We had therefore to prosecute the journey on foot until we reached Palepattoola.

Owing to the uninhabited state of the country through which the route lay, we could not expect to be often accommodated with a hut to sleep in. Mr SAWERS had therefore provided a tent. On this account, the number of followers was greatly increased. Including the coolies who carried the tent, chair-bearers, baggage-coolies, servants, &c. the whole party consisted of about ninety individuals.

Although our road passed through ever-verdant forests, and frequently within view of some grand and picturesque displays of inanimate nature, still the scene was seldom particularly pleasing. Tropical woods of great extent present few objects capable of exciting delightful emotions. A gloomy silence prevails in these solitudes to a remarkable degree. The stillness and absence of animated nature is more striking while the sun sheds his ardent meridian rays on the earth, than during any other time of the day.

When the sun was high, we seldom saw an animal of any kind, except a few butterflies flickering in the air, and occasionally a crow-pheasant flitting from one bush to another. Few scenes give intense and permanently pleasing emotions, which are not more or less connected with the labours and comforts of man. While vegetable nature abounded with the most wanton luxuriance, there were many parts of our journey where, except the insect tribe, no animated being seemed to exist.

When opportunities offered, we endeavoured to obtain some information regarding the moral habits of the people. The guide, who was caught in the jungle shortly after we left Welle Malloo, furnished us with a few facts regarding the exposure of female infants in his part of the country. The practice of several men (frequently brothers) cohabiting with one woman is very general in almost every part of the Kandyan provinces. As reasons for this species of copartnership, the poor assign want of means to support individually a woman; while the wealthy say, that they adopt this measure for the purpose of concentrating the property of several males among the children of one woman. No one of the males has a better right to the denomination of husband than another. In consequence of a difference of opinion, the partnership is occasionally dissolved; in which case, an appeal is sometimes made to the magistrate, to decide with whom the woman should domiciliate, as also regarding the appropriation of the common offspring.

Captain Riberio, who spent eighteen years in the woods of Ceylon, gives a very particular account of the practice of polyandrism among the Kandyans. He says, "La premiere nuit des nôces est pour le mari, la seconde pour le frère du mari, et s'il y a un troisième ou un quatrième frère, jusqu'au septième, ils ont chacun leur nuit, mais s'il y a plus de sept frères, le septième, et ceux qui sont après,

n'ont pas le meme droit que les six autres. Le premiers jours passé, le mari n'a pas plus de privilege que ses frères: lorsque la femme est seule il peut la prendre: mais si l'un des frères est avec elle, il ne peut pas entrer: ainsi une femme suffit pour toute une famille, et tout est commun entres les frères; ils apportent à la maison ce qu'ils gagnent, les enfans ne sont pas plus au mari qu'a ses frères, aussi les enfans les appellent tous leurs pères." RIBERIO dignifies one of the brothers with the title of husband, while he withholds it from the other members of the corporation. I never could learn that any one of the fraternity had a greater claim to this appellation than another.

The Kandyans have no idea of the meaning we attach to the word wife. A female, who lives as a wife with a man, is denominated by a word in the Singhalese language expressive of "the woman who cooks and gives." A Kandyan may *call* as many women to his bed as he pleases, and when he chooses he may send them back to their relations, provided he returns the property they brought along with them. Separations of this kind cause no disgrace to either party. KNOX was perfectly correct when he stated, the woman, after she is dismissed, becomes "fit for another man, being as they account never the worse for wearing." Sterility is sometimes assigned as a cause for repudiation. In such a case, the female frequently succeeds in prevailing upon the husband to *call* one of her sisters, when she has any.

When a female is *called* by a male, the connexion is denominated *diga dilaw*. By a union of this kind the female loses all hereditary right to the property of her father's family; she is, in fact, completely transferred to that of her husband. The privilege of repudiation is not reciprocal. A woman can only leave her husband when she proves that he has omitted to supply her with food and clothing suitable to his rank.

There is another kind of connexion between a male and female, denominated "*beene wasse.*" In this union, the female remains in her own house, or the house of her father, and cohabits with one or more males as she pleases. There is no disgrace attending such conduct. By this means, she does not lose a right to a share of the property of her family. The man who cohabits with her she may turn away at pleasure: he has no claim upon her or her property. In allusion to the rapidity with which a man, who has formed a *beene wasse* connexion, may be dismissed, the Kandyans say, he should always be provided with a *staff* and a *lantern.* The progeny of a *beene wasse* connexion never speak of their father; they assume a station in society suitable to the rank of their mother.

According to the information we obtained, the exposure of female infants is a frequent occurrence in some of the districts through which we passed. When an infant is born, the male-parent proceeds to the residence of an astrologer, who is consulted regarding the future fortune of the new-born. The fee given to an astrologer on such an occasion, in general, consists of one *chally,* a copper coin, value about a farthing, and forty betel-leaves. The stars are then consulted, according to the gibberish of the pretended wise man. Should the astrologer discover that the infant has been born under a lucky star, and that it will be fortunate through life, the parent returns home, and reports the circumstance to the mother, who commences to nurse her offspring. A different fate awaits an infant which is supposed to have come into the world under the influence of an unlucky planet or star. The old woman who assisted at the birth of the babe, sometimes accompanied by the father, proceed to the jungle, where they dig a small hole in the earth: here they deposit the infant, which is in general soon devoured by jackals. We were

informed that mothers sometimes evince much reluctance to allow their infant to be exposed. But as the rearing of unlucky infants is supposed to bring misfortune upon the parents, the yearning of the mother yields to the confidence she has in the prediction of the astrologer; and, to prevent an imaginary and contingent evil, the poor infatuated woman consents to the murder of her offspring. In some rare instances, a mother sends a messenger to the jungle the day after the infant has been exposed, for the purpose of ascertaining its fate. Should it be found alive, this circumstance is considered a favourable omen, and the poor babe is commonly brought home to the mother, who now performs her duty to the little innocent.

The astrologer easily learns the nature of the prediction regarding the fate of an infant which will please the parent. Male-children are much desired; hence infants of this sex are seldom deemed to be born under an unlucky star, and very rarely exposed. The first female infant born in a family is generally considered lucky, and therefore not exposed. The succeeding daughters are sometimes deemed unlucky, and murdered accordingly. Our informant on this subject said, no poor man ever thought of bringing up more than one of his female offspring. He likewise told us, that very few parents, even of the wealthier class, would, if they had a son, save three daughters. By a census, which was taken of the inhabitants of the Kandyan provinces in 1820, the proportion of females to males was as 84 is to 100. In one of the districts the proportion was as low as 55½ to 100. It may be feared that the murder of female infants is a principal cause of the disproportion between the numbers of the sexes. We are not warranted in presuming that a warm climate has any influence in this respect. MALTE BRUN asserts, that it has been satisfactorily demonstrated by good authority, that "the number

of children of both sexes is not more disproportionate in the East than in Europe." According to the last census, the number of females in Great Britain is greater than that of males; and by a census taken of the inhabitants of Java, by Sir T. Raffles, we learn that the proportion of females to males in that island is as 103 to 100. During last year a proclamation was issued by the governor of Ceylon prohibiting infanticide. Some hopes may therefore be entertained that this horrid practice will soon be rendered less frequent, if not completely repressed. The late king of Kandy prohibited the exposure of infants among his subjects, but his measures had little if any effect, in checking the practice, particularly in the districts distant from the seat of government.

Edinburgh,
January 1823.

XXXI.—*Some Observations on the* Falco chrysaëtos *and* F. fulvus *of Authors, proving the Identity of the two supposed species.*

By P. J. SELBY, Esq.

(*Read 25th January* 1823.)

IN Mr WILSON's excellent and scientific observations on some species of the genus Falco, contained in the second volume of the Society's Memoirs, he has stated it as his belief, that the Golden and Ring-tailed Eagles (*Falco chrysaëtos* and *F. fulvus*) of authors, are in reality distinct species, and cannot be considered as individuals of the same kind, varying only in plumage, from a difference of age or sex. In this opinion, I believe, he still remains supported by many ornithologists.

In consequence of his remarks, and of certain doubts as to their correctness, which I was led to entertain from the remarkable changes I had seen developed in the *Falco albicilla*, or Cinereous Eagle, during its progress to maturity, I was induced to pay particular attention to the history of these birds, and especially to the changes of plu-

mage to which they might be subject,—from the state of nestlings to the attainment of maturity. The result of my inquiries and observations has been such as to convince me, that no *specific* distinction exists between the Golden and Ring-tailed Eagles, but that the difference arises entirely from a difference of plumage proper to the respective ages the individuals. In this opinion, I am also supported by the powerful and concurrent testimony of Mons. TEMMINCK, who, in his *Manuel d'Ornithologie*, considers the Ring-tailed Eagle to be the young of his Aigle Royal, the *F. chrysaëtos* of authors.

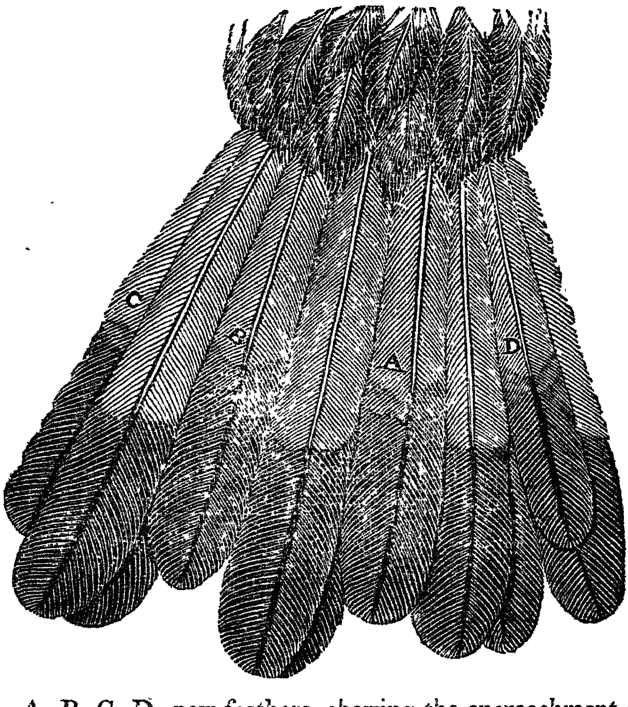
My attention was also directed to the anatomical structure of the two supposed species, as I considered that a strict conformity in this respect would constitute a strong argument in favour of their identity. The difficulty of procuring subjects, for some time prevented me making the comparison I wished; but I was at length fortunate enough to obtain, though at different times, a specimen of each kind, and, as far as I can rely upon the accuracy of my own observation, or the notes taken at the dissection of each, their structure appeared the same. In such outward essential characters, as are visible to all observers, viz. the bill, legs, scales upon the last phalanges of the toes, &c. an exact accordance also exists.

Another fact that forcibly struck me, was, that all those eagles which I had an opportunity of examining, and which had been kept in confinement beyond a certain age, proved of the golden or *chrysaëtos* species; although, I was informed, when young, they had exhibited the white caudal band of the Ring-tailed Eagle (*F. fulvus.*)

The progress of this change I have been fortunate enough to witness in a bird, which I obtained from Scotland a few years ago. When first procured, it was about fourteen months old, and at that time exactly answered the

general description of the Ring-tailed Eagle. Soon afterwards it began to moult. I attentively watched the progress of the moulting. The tail-feathers, after the change was completely effected, were now considerably altered in appearance; as the line which divided the white or basal half of the tail from the other part, and which, previous to moulting, was distinct and well-defined, became somewhat interrupted or irregular, by spots of a hair-brown and ash-grey encroaching upon the white. At each succeeding periodical change of feather, these spots and blotches increased in number and size, advancing upwards upon the white, in form of indistinct bars, till the whole, with the exception of the roots of the feathers, which appear always to remain white, became clouded with brown and deep ash-grey,—the characteristic colours of the tail of the *F. chrysaëtos*. This was accomplished a short time ago, when the bird had attained its fourth year. Except in size, it now resembles in its markings a magnificent specimen of the Golden Eagle, which I also possess alive, and which I received from Scotland, but not till after it had attained the adult or mature state. The habits and manners of these birds are similar, and their note is the same.—In further confirmation of this change, I may add, that, in the autumn of 1821, when upon a tour to the Highlands of Scotland, I had an opportunity of examining two confined eagles at Mar Lodge, the hunting-seat of the Earl of Fife. They were then about fourteen months old, having both been taken from the same eyry the summer of the preceding year. One of them had commenced moulting, and had already renewed several of its tail-feathers, which were readily to be distinguished from the old rectrices, not only by their freshness and gloss, but by the encroachment of several ash and hair-brown spots upon the white caudal band. A sketch of the appearance it then exhibited was

made upon the spot, a copy of which accompanies these remarks. The other had not begun to moult, and its plumage answered the description of the Ring-tailed Eagle.



A, B, C, D, new feathers, shewing the encroachment of the brown and ash coloured patches upon the white or upper half of the tail.

M. Temminck, in a note, also informs us, that he kept two eagles of this kind in confinement for many years, both of which underwent the gradual change of plumage, from the Ring-tailed to the Golden Eagle. With such strong and well authenticated facts, we must either believe that

the two supposed species constitute in reality but one, or that the young of two distinct species, at first precisely similar in colour, appearance, and manners, differ in this respect, that, in the one, the white caudal band gradually gives place to a different arrangement of colours,—while, in the other, it remains permanent and unaltered. No direct evidence, however, has, to my knowledge, been advanced, to shew that this white ring is ever permanent; on the contrary, every experiment hitherto instituted or made, with living birds, proves that a gradual change is effected. Ought we then to permit, the mere assertion of PENNANT, or other writers, without a statement of the facts upon which such assertion is founded, to outweigh evidence so conclusive as that now advanced? That the Ring-tailed Eagle should appear to be more numerous in Britain than the Golden Eagle, as Mr WILSON asserts, and I believe to be the case, cannot be a matter of surprise, if we consider the number of young annually produced, and the period that elapses before maturity is attained, and that during the slow progress to this state, or at least for the space of two years, it may, by superficial observers, or where an opportunity of close examination is not allowed, be considered as a bird of the ring-tailed species. We also find that young animals are seldom so wary or attentive to their own preservation as adults, and are therefore more liable to be shot or otherwise destroyed, and thus more frequently come under examination, than those which, with age and maturity, have acquired a superior degree of intelligence and cunning. Young birds (particularly of the genus Falco) are also generally driven from the place of their birth by their parents, when fully fledged, and able to provide for themselves; and to this cause, I imagine, must be attributed the wider and more general dissemination of the Ring-tailed, compared with its parent the Golden Eagle.

With respect to Mr WILSON's remark, that although the adult specimen of the Golden Eagle in the Sprunglian Cabinet at Berne, appears to bear a close resemblance to that in the Parisian Cabinet; yet, that the supposed young of this species in the latter collection, answering the description of the *F. fulvus*, or Ring-tailed Eagle, is different from the young of the Golden Eagle preserved by M. SPRUNGLI, I beg to suggest, that this specimen may perhaps be the *Falco imperialis* of TEMMINCK, the *F. mogilhik* of authors,—a bird which, in its mature state, closely resembles in plumage the Golden Eagle, *F. chrysaëtos*. It is also called Gold-adler by some of the German writers; and what inclines me to think that this may be the case, is, that Mr WILSON's description of this young Golden Eagle, approaches very near to that given by M. TEMMINCK of the young *Aigle imperial*, *Falco imperialis*, or *mogilhik*. It is therefore upon the evidence of ocular demonstration, and the concurrent testimony of others who have made the like experiments with living birds, that I ground my opinion of the identity of the Golden and Ring-tailed Eagles; and I venture to hope, that, in removing this Ring-tailed Eagle, as well as the Sea Eagle (*Falco ossifragus*), from the station they occupy in the British Fauna, as distinct species, I shall not incur the imputation of having done so, without due consideration, or sufficient and satisfactory grounds.

XXXII.—*Remarks on the different Opinions entertained regarding the specific Distinction, or Identity, of the Ring-tailed and Golden Eagles.*

By James Wilson, Esq. M. W. S. &c.

(*Read 22d February* 1823.)

THE question concerning the identity of the Ring-tailed and Golden Eagles has been again entered into, and the probability of such identity actually existing was maintained and illustrated by Mr Selby, a very skilful and zealous ornithologist, in an interesting and ingenious paper lately read to the Society. As such opinion is in opposition to the one which I have advocated at some length, in a paper on certain species of the genus Falco, some years since honoured by the Society with a place in the second volume of its Memoirs, and as I still adhere to the sentiments which I then expressed, I think it due, as well to the maintenance of my own opinion, as to the free spirit of discussion which has always pervaded our inquiries, to state without reserve what has occurred to me on Mr Selby's paper.

The state of opinion at present regarding these birds seems to be as follows. There are three theories on the subject.

1*st*, The oldest, and probably most general opinion, is that of their constituting two separate and distinct kinds, hitherto distinguished by the names of the Golden and the Ring-tailed Eagles (*F. chrysaëtos* and *F. fulvus*, LINN.)

2*dly*, There prevailed in France some time ago, and I believe still exists in that country and elsewhere, an opinion that these birds were not specifically distinct, but were merely the adolescent and mature states of one and the same species,—the Golden Eagle being considered as the young of the Ring-tail, which latter was supposed to represent the plumage of the perfect bird. And,

3*dly*, There also prevailed a belief (now strengthened by the concurrence of Mr SELBY) similar to that last mentioned, in as far as these birds are considered as specifically the same, but differing in this, that the Ring-tailed Eagle is considered as the *young* of the Golden Eagle, and not as the *parent* of that supposed species.

Notwithstanding the arguments which have been brought forward by Mr SELBY and other competent judges, I still continue to adhere to the first opinion, that which advocates the distinction of the species. It will not of course be insisted upon that I should assign particular proofs in support of my belief in this specific distinction, because the opinion which I maintain is that which has been supported by the whole mass of ornithological authorities from the most remote periods of the science downwards, till within these last few years, and therefore the *onus probandi* may fairly be supposed to fall on the other parties. Leaving, therefore, for the present, the old opinion to stand its ground till such time as it be disproved by positive facts,

established by a continued series of observations, I proceed to state a few of those arguments which I think may fairly be objected against the other more recent opinions,—and, first, regarding that which maintains that the Golden Eagle is the young of the Ring-tail.

The uncertainty which recently prevailed on this point, was the reason why more minute and careful attention was bestowed upon it by some of the French ornithologists, with whom I believe the doubt itself originated. In consequence of this, the specimen of the Golden Eagle preserved in the aviary of the King's Garden in Paris, was particularly examined from time to time for a series of years, but no change was perceived to take place sufficient in any degree to warrant the belief, that that species ever passed into or assumed the plumage of the Ring-tail. The specimen alluded to is now six or eight years old; and as no bird is known to require more than one-half of that period to attain maturity, the French ornithologists have naturally inferred, that had the individual under their inspection been destined to undergo such mutation at all, it would have done so before now. Hence they conclude that these species are distinct. Baron Cuvier, in referring to this subject of dispute, affirms, "Il y a meme des naturalistes qui croient que l'Aigle Royal n'est qu'un jeune de l'Aigle Commun; mais on en élève un, depuis plusieurs années à la menagerie, qui conserve toujours sa *queue barrée de noir et de gris* *." I need scarcely remark, that the *Aigle Royal* and the *Aigle Commun* of the French are synonymous with the Golden and Ring-tailed Eagles of the English ornithologists.

* Note to the "Regne Animal," t. i. p. 314.

Besides the strongly-marked distinction in the plumage of the tail, the colour of the iris is usually different in these birds, that of the Golden Eagle being yellow, that of the Ring-tail hazel. This character, I am aware, is subject to variation; and I therefore mention it under the objection, arising from that uncertainty, which many may annex to its value as a specific character. But it may fairly be argued, that every external character, taken singly, is subject to exhibit occasional discrepancies, and that this character is as permanent, and therefore as valuable, as many others; not, to be sure, as a positive specific distinction viewed singly, but yet as a very strong corroboration, when considered in its generality, and as connected with other circumstances. It may be worth while, moreover, to consider for a moment the nature, as well as the value, of this variation. There is no doubt, in the first place, of the fact, that the colour of the iris in these birds is *usually* different, the Golden Eagle's being, as I have stated, bright yellow, the Ring-tail's deep hazel. Now, if it can be shewn, that in either of these, or in any other species, there is a regular and customary change of the iris from one colour to another taking place, like the changes in the colouring of the plumage, in consequence of an advance to maturity, then I confess that the argument to be derived from a disagreement in this character between the two birds in question would be greatly, if not altogether, invalidated. But I maintain, that this imagined change does not take place, or at least has never yet been ascertained, or even asserted to take place, in consequence of an advance from youth to age; that it is an accidental circumstance taking place rarely, and irregularly, and not characteristic of, or in any way connected with, a particular period of life. It follows, therefore, that this distinction, being usual between the birds hitherto named the Golden and the Ring-tailed Eagles,

and yet not the result of a difference in age, may be regarded as of very considerable value in the discrimination of the species, and adduced as a fair argument in proof of their distinction.

I shall now refer to some more general considerations, which I should deem of themselves sufficient to prove that the Golden Eagle cannot be regarded as the young of the Ring-tail.

In the British dominions, the Golden Eagle is, perhaps, the rarest of the feathered tribe. The Ring-tail, on the contrary, though no where abundant, is yet sufficiently well known, and is called the Black Eagle in the Scottish Highlands, to distinguish it from the Great Erne, or Sea-Eagle, the most numerous of the British aquiline birds. In Switzerland, and among the Alps of Savoy, Northern Italy, and the Tyrol, the Ring-tail is the most common species of any; whereas the Golden Eagle continues to be there, as it is with ourselves, a bird of comparatively rare occurrence. Now, it appears, I think, reasonable to conclude, that if the Golden Eagle were merely the young of the Ring-tailed Eagle, it would not only be as common as that species, but much more so; because, if every pair of adult Ring-tailed Eagles breed once in each season, and produce two young at a brood, and if these young take three years to attain their perfect plumage, it follows, that at the lapse of every period of three years, there would be three pair of young Golden Eagles for every single pair of adult Ring-tailed Eagles which existed at the commencement of that period,—in other words, that the Golden Eagle would be at least three times more common than the Ring-tailed one. The reverse of this is, however, the case; the Ring-tailed Eagle being not only three times, but probably six, or eight, or even ten times more common than the Golden one. How, then, can it be the parent of that species?

This terminates what I had to state in the way of objection to the *second* opinion. I come now to the *third* opinion (that of Mr SELBY), which reverses the preceding one, and maintains that the Ring-tailed Eagle is not the parent, but the young of the Golden Eagle. This view of the subject accounts, to a certain extent, for the much greater frequency of the one than the other, and in so far it escapes the objection arising from the disparity in point of numbers, which I deem insuperable in regard to the second opinion; but in every other respect I incline to view it as even more improbable, or at least more inconsistent with the known analogies, than that opinion itself.

In a small journal which I kept during a tour in Switzerland a good many years ago, there are the following notes on this subject, afterwards inserted in my remarks on the genus Falco, and referred to in Mr SELBY's recent observations.

"In the celebrated collection of Swiss birds, formed by the late M. SPRUNGLI of Berne, the specimen of the Golden Eagle resembles in all respects that in the Parisian cabinet; but the bird in the latter collection, supposed to be the young of that species, by some of the French naturalists, though described as a distinct species by preceding writers on ornithology, under the name of *F. fulvus*, or Ring-tailed Eagle, is not the same as the young of the Golden Eagle preserved by M. SPRUNGLI.

"This, conjoined with some other circumstances, induces me in this instance to doubt the accuracy of the Parisian nomenclature.

"In the Swiss specimen, which is known to be the young of the Golden Eagle, *the tail has no appearance of a ring or band at the base.* The feathers there are bluish-black, barred with brown and ash colour, the overlying central tail-feathers being likewise barred, but the ground colour

is brownish-black. The bill is of a deep blue colour, darker towards the tip. Cere and irides yellow. Head and neck brown and tawny; the feathers long and pointed, and, particularly towards the back of the neck and hinder part of the head, tinged with bright ferruginous or rust colour. The general colour of the plumage is dark-brown, with shades of tawny and ferruginous. Quill-feathers of a chocolate colour, with white shafts. Legs yellow, large, and feathered to the toes; toes large and scaly; claws black. It bears a close resemblance to the adult bird, but the feathers on the thighs are lighter in colour, and spotted irregularly with white."

If the preceding description be correctly taken, and if I was not in error regarding the species from which I took it, it would, of course, follow, that the Ring-tail is not the young of the Golden Eagle, and Mr SELBY's opinion would fall to the ground. Mr SELBY, therefore, supposes that the bird in SPRUNGLI's collection was the young, not of the Golden Eagle, but of the *Falco imperialis* of TEMMINCK. This bird, I presume Mr SELBY is aware, is one of remarkably rare occurrence in Switzerland, and, indeed, in all the western and central parts of Europe. It is, in fact, quite a southern species, having its centre of dominion in Egypt, and along the coasts of Barbary. The ground-colour of all the inferior parts of the plumage in the young bird is of a reddish-yellow, or what the French call Isabella-colour. The breast is spotted; but the throat, thighs, and abdomen, are Isabella-colour, and quite immaculate. Several feathers of the scapularies are spotted with white, and these in the adult bird become, as M. TEMMINCK observes, *d'un blanc pur*.

"It will be easy," says the author of the *Manuel d'Ornithologie*, "to distinguish the Imperial from the Royal or Golden Eagle, by the preceding characters, especially by

the beautiful white scapulary feathers of the old Imperial Eagle, which are always wanting in the golden one. *As to the young of these two species, they are so dissimilar in the colours of their plumage, that it is impossible ever to confound them* *."

Had Mr SELBY himself seen the specimen in the Sprunglian cabinet, from which I took my description, and had he been then of opinion that it was the young of the *Falco imperialis*, his extensive experience, and the general value of his sentiments on such subjects, would have caused me some hesitation in admitting the nomenclature even of the well-practised ornithologist of Berne; but having shewn, by the testimony of M. TEMMINCK, that there is no likelihood of the one being ever confounded with the other, I am free to confess, that I think it very improbable that I should have been mistaken in this instance, although such a mistake would certainly suit the views of those who maintain the identity of the Ring-tailed and Golden Eagles. All I can add on this point is, that the specimen described by me was believed and asserted to be the young of the Golden Eagle by those who had spent their lives in the mountainous districts of Berne, and other central parts of the Swiss Alps, where these species, whether distinct or otherwise, are at least as well known as they can be in any other part of the world. There was no specimen of the *Falco imperialis* itself; nor did I ever hear any thing said or hinted regarding either the occurrence of that bird in the territory of Berne, or the liability of confounding its young with those of either of the other two.

The observations made by Mr SELBY are certainly well deserving the attention of ornithologists, and, together with

* T. i. p. 40.

those of TEMMINCK, they at least shew that certain anomalous changes of plumage take place, either occasionally or usually, of which preceding naturalists were not aware. But the following simple fact, which I am able to state, both from personal observation, and the concurrent testimony of those who have passed the greater part of their lives in the spot alluded to, and its neighbourhood, would of itself be sufficient to prevent my drawing the same conclusion as that at which Mr SELBY has arrived. In Jura, one of the Western Isles, there are two species of eagle inhabiting the least accessible of the cliffs. These are the great Sea-Eagle or Erne, and the Ring-tail, of which the latter is the more numerous. But no bird in the plumage of the Golden Eagle has been found there that I can learn, within the memory of man. The mature Ring-tail is known to haunt and breed there every season, and may often be seen by the tourist or the sportsman soaring in magnificent circles above its ancient eyrie. Further, in the *Fauna Orcadensis* of the Reverend GEORGE LOW, an accurate and interesting volume, made public some years ago by Dr LEACH, I find the following notice of the Ring-tailed Eagle. "The great characters which distinguish this from other species of eagles are, a large broad band of white, which encompasses the root of the tail; the legs, which are feathered to the very feet; and in some (which perhaps may be the young) the head is hoary. It is of a large size, and very frequent in the hills, where it makes its nest in the rocks, which is often placed within reach, and, when this is the case, always becomes a prey to destruction. These birds are very strong, and make vast havock (in breeding-time especially) among lambs, young and old swine, which they often destroy in the mountains, rabbits, and poultry. A clergyman some time ago told me, he met with one of them mounted in the air, with a pretty large

pig in her talons, which she dropt alive upon his firing at her. We have even a tradition here of an eagle's having taken up a child from behind some reapers, in the parish of Orphir, and carried it to her nest in Hoy; but by the assiduity of the people, who immediately followed her, the child was rescued unhurt *."

The Work from which the preceding extract is taken, was executed by one who passed more than twenty years in the Orkney Islands, and who, possessed of more than usual zeal for the study of natural history, and encouraged by the friendship and patronage of Mr PENNANT and Sir JOSEPH BANKS, was anxious to render the result of his observations as complete and comprehensive as possible. *But there is no mention whatever made of the Golden Eagle as an inhabitant of the Island of Hoy, or any of the Orkney Islands.*

The well-known circumstance of the extreme attachment of old eagles to the places of their accustomed incubation, and the fact alluded to by Mr SELBY, of their driving off their young to shift for themselves elsewhere, as soon as sufficiently fledged, would, of course, in these instances of Jura and Hoy, increase, instead of diminishing, the probability of encountering the mature and perfect bird, rather than the young †. I am altogether unable to account for

* The same story is told in a somewhat different manner by Sir ROBERT SIBBALD in his *Scotia Illustrata*.

† I hope I shall be excused for transcribing in a note the following fine description of the above-mentioned trait in the character of the parent eagle. It is by THOMSON, whom PENNANT used to call the *Naturalist's Poet*.

> High from the summit of a craggy cliff,
> Hung o'er the deep, such as amazing frowns
> On utmost Kilda's shore, whose lonely race
> Resign the setting sun to Indian worlds,

this circumstance of the non-occurrence of the Golden Eagle upon Mr SELBY's theory.

Reasoning from analogy, we should expect quite a different succession of colours from that which is presumed regularly to take place by those who coincide in Mr SELBY's opinion. For example, in the case of the Sea Eagle, and the White-tailed Eagle, so long described as distinct species, but now ascertained and admitted to be the same, we find that those with the brown tail are the young, and that the great proportion of white, which is afterwards assumed, is the characteristic mark of the matured species. And in his description of the *Falco imperialis*, still more nearly allied to the Golden Eagle, M. TEMMINCK writes as follows: "Les individus un peu *plus avancés en age*, ont des teintes *plus foncées*; le *blanc* sur quelques-unes des plumes scapulaires est plus *marqué*, et quelques *plumes noirâtres* et d'un *brun foncé*, paraissent sur toutes les parties du corps." Indeed, I believe that although no general principle has hitherto been formally established on the subject by ornithologists, yet most of those who are conversant in the general changes of plumage will admit, that a change from

The Royal Eagle draws his vigorous young,
Strong pounc'd, and ardent with paternal fire.
Now fit to raise a kingdom of their own,
He drives them from his fort, the towering seat
For ages of his empire; which in peace
Unstain'd he holds, while many a league at sea
He wings his course, and preys in distant isles.

The circumstance alluded to, of the old eagle driving its young to a distance, whether it is as true as THOMSON has rendered it poetical, is consistent with early observation. It is related by PLINY: "Adultos persequitur parens, et longè fugat, æmulos scilicet rapinæ. Et alioqui unum par aquilarum magno ad populandum tractu, ut satietur, indiget." See Dr AIKIN's *Essay on the Application of Poetry to Natural History.*

one or more pure, unmixed, and distinctly expressed colours, into those of an obscure, ill-defined, and mixed nature, is in opposition to all the known facts from which any thing like a general principle could be evolved. Now, the change maintained to take place by Mr SELBY is a change from a pure and unmingled black and white, to a mingled combination of black, brown, ferruginous, and ash colour.

I believe, that if any one general law regulates the changes in the plumage of birds, it is this, That if any given species exhibits, in an important part of its plumage, a combination of comparatively obscure shades of black, brown, dusky, ferruginous, and other colours, intermingled with each other, and, if other individuals of the same species exhibit the like important parts of their plumage, composed, not of these obscure and mingled colours, but of two simple and strongly contrasted colours, such as black and white, we may, with as much certainty as any inductive process warrants, infer, that the combined and less distinct colours belong to the immature,—whilst the purer, unmixed, and more strongly contrasted colours, adorn the parent birds. This I look upon as a law of Nature: it is a general truth, derived from the consideration of common properties in individual facts, and is therefore a legitimate induction. For the sake of those who may not have convinced themselves of this fact from observation, and who may naturally enough feel disinclined to rest their belief upon a mere assertion, I beg leave to mention a few examples which at once occur to me out of the numerous instances which a special investigation of the subject would bring to light, in confirmation of the rule. In all the following species, there are important parts of the plumage which change from various obscure shades of brown, dusky,

and ferruginous, to simple and distinct bands or portions of black and white, or into one or other of these two; viz. the Sea-Eagle, the Peregrine Falcon, the Goshawk, the Hen-harrier, several Butcher-birds, several Fly-catchers, the Grey Wagtail, the Pied Wagtail, the common Sparrow, the Goldfinch, the Black-headed Bunting, the Blackbird, and the Ring-ouzel, exclusive of almost the whole tribe of Gulls, Mergansers, and many other aquatic fowls. Now, the change assumed to take place by Mr SELBY is in exact opposition to these and many other instances; for, if his idea be correct, the broad black and white bands of the tail, which have hitherto (independent of all general reasoning) been considered as the chief mark by which to distinguish the Ring-tail from the Golden Eagle, are merely the characters of immaturity, and are parted with at an after period, and their place supplied by the more obscure and clouded colours already referred to.

A mature bird is generally characterised by the depth and clearness of its colours, by their greater contrast when different, and their greater uniformity of hue when the same. But the Ring-tail (the supposed young) is much darker and more uniform in its general plumage than the Golden Eagle; and the broad and strongly contrasted bands of black and white on the tail form apparently a very distinguishing character, and one which, according to PENNANT, it maintains in all its stages, and in every country where it is found. The difference in the colour of the iris, too, if a valid objection at all, is of course equally available against the opinion which I am now contesting, as it was against the one previously discussed. I may add, that, as far as my limited reading enables me to judge, the geographical distribution of the Ring-tail is considerably more extended (at least in a northerly direction) than that

of the Golden Eagle, the former stretching as far as Hudson's Bay in Lat. 64° or 65°, the latter being confined within the 56th or 57th degree *.

On the whole, I still feel inclined to recur to the question which I formerly put, while treating of this contested point: If the birds in question were specifically the same, and supposing the white band to be merely the colour of immaturity, would not the individuals in the more advanced state of plumage approximate more nearly to the adult bird, so that by degrees all distinctions must be effaced, and they could not be recognised but as one and the same? Whereas, on the contrary, we find that the more perfect the plumage of the bird becomes, the more apparent are those characters which have hitherto entitled it to rank as a distinct species, and that it is chiefly between the young of the two species that there is any difficulty in discriminating. In corroboration of this, I may mention the specimens in the possession of the Duke of Buccleugh, one of which, it may be in the recollection of some here present, I formerly exhibited to the Society. Its plumage is of a deep clear brown, like dark mahogany; and its whole aspect, both in respect to colour and condition, indicates a bird in what

* The Ring-tailed Eagle occurs in Northern Europe, at least as far as Drontheim. According to PALLAS, it also inhabits the highest rocks of the Uralian Chain, where these are free from wood. The independent Tartars train it for the chace of hares, foxes, antelopes, and even wolves. This noble amusement was observed by that curious traveller MARCO POLO, while at the court of the Great Cham of Tartary, so far back as the year 1269. The Tartars esteem the feathers of the tail as the best they have for pluming their arrows. PENNANT, in describing a northern specimen of this bird, observes, "The tail is white, tipt with black; *but in young birds dusky, blotched with white.*" I have not been able to trace the Golden Eagle to any of the above mentioned countries. See LEEMS, p. 233; M. POLO, in PURCHAS's Collection, t. iii. p. 85; and PENNANT's *Arctic Zoology*, vol. ii. p. 195.

may be called *the prime of life.* It has none of the irregular lighter markings of the Golden Eagle, and its tail is strongly barred with pure black and white.

I fear I have already occupied too much of the Society's time on this subject, which I certainly intended to have discussed within narrower limits. I shall therefore conclude, by observing, that till such time as the reverse be actually demonstrated by the taking of a young bird from the nest or eyrie of a *breeding Ring-tail,* and the subsequent transmutation into the plumage of the Golden Eagle actually proved by the continued observation of the same individual, and, also, until the circumstance of certain highland districts and islands being inhabited by one of the alleged varieties, and not by the other, be satisfactorily explained and accounted for, I shall certainly prefer adhering to the old opinion, that the *Ring-tailed* and *Golden Eagles* form two *distinct species.*

PLATE XIII

MARK YARWOOD

XXXIII.—*On the Natural Expedients resorted to by* MARK YARWOOD, *a Cheshire Boy, to supply the Want which he has sustained from Birth, of his Fore-Arms and Hands.*

By S. HIBBERT, M. D. F. R. S. E. M. W. S. &c.

(*Read* 11*th January* 1823.)

BEFORE entering on the narrative which I beg leave to submit to the Society, I shall venture to make a few general observations relative to cases of organic privation. In describing the means employed by any individual to remedy the loss of certain organs of the body, I consider that the term *natural expedients* ought to be used in contradistinction to the *mechanical* or *artificial devices* which may be resorted to with the same object in view: for, while the devices termed *mechanical* are produced by the improvements of science, or the requisitions of civilized society; those expedients, on the contrary, which may be strictly comprehended under the designation of *natural*, are such as would first suggest themselves to man in the untaught infancy of life, or would be adopted by him, to the exclusion of artificial contrivances, in a savage state. In fact, they are exertions of certain organs of the body substituted for other parts, the object of which is to compensate for the priva-

tion which may have occurred;—these nearly instinctive efforts being, at the same time, aided by an admirable law of our frame, by which it is ordained, that whenever, either from choice or necessity, the increased energies of any particular organ are required, a corresponding and extraordinary degree of ability in accomplishing the motions required, is the undeviating consequence.

I need not remind the Society that there are on record several cases of individuals, who, having sustained from birth a complete privation of their arms, have rendered their toes such excellent substitutes for fingers, that, with these members, they have executed works of art, such as are ranked amongst the most difficult of manual operations. It is also no less remarkable, that these persons, although existing at different intervals of time, and dwelling in different parts of the globe, should, in the course of remedying their deficiency, have severally availed themselves of similar natural expedients.* In judging, then, from these instances, it would appear that a more than common increase of skill in the use of the toes, ought to be considered as a result constantly attending the total loss of both arms; for which reason, it may not appear too trivial an employment, if we endeavour to ascertain the resources to which a human being may have been urged, who has sustained from birth a privation of the arms rather less than that of the instances cited, being of such a kind, that, instead of taking place immediately below the shoulder joints, it has commenced from the elbows. An instance, however, where the fore-arms and hands have been wanting from birth, and the stumps of the ossa humeri brought into action, may be deemed as of the rarest description; only

* A few of these cases, which I have collected, are subjoined as an Appendix to this Memoir.

one case of the kind having ever, I believe, been communicated to the public*: on which account, I flatter myself that this narrative, respecting a boy thus circumstanced, whom I accidentally met with, in the course of the last autumn, at an obscure village in England, may not prove wholly uninteresting. We shall at least learn from this instructive example, that the mere stumps of the *ossa humeri* are not only capable of being applied to the greatest use, but that, admirably as the hands are constructed for the exigencies of man, their total loss, even though the toes should not be required to act as their substitutes, is by no means irremediable.

Mark Yarwood, the subject of the present memoir, is the son of poor, but respectable, parents, dwelling at Ashley, a small village, included in the parish of Bowden, in Cheshire. He was born without fore-arms and hands; has arrived at the age of twelve; and is now a fine, stout, healthy-looking boy, of a lively and cheerful temper, and good disposition. On each of the *ossa humeri* there are prominences which bear a faint resemblance, in their appearance and situation, to those of the external condyles, whence two prolongations, one on each arm, may be observed, which are slightly bent inwards; neither of them, however, is much more than an inch in length, while that of the left limb is perhaps about a quarter of an inch longer than the one which terminates the right *os humeri* †. (See Plate

* The case of a German, mentioned in p. 459 of this volume, and communicated to the Society by Gilbert Innes, Esq. upon the occasion of reading this paper.

† The measurement of the Ossa humeri and their projections, sent me by a medical friend since drawing up this Memoir, may be stated as follows; it being necessary previously to remark, that the distance between the nearest

XIII.) As the bones of these prolongations feel as if they were bifid at their extremities, they might probably be each considered as the scanty rudiments, or even relics, of an ulna and radius; while their firm and immoveable junction with the *ossa humeri* might be interpreted as the result of a process of anchylosis. But this view, though calculated to serve the purpose of anatomical description, meets with little countenance from physiology; there is not the least indication that a joint ever existed, nor are there any signs of demarkation between the *ossa humeri* and the short processes which form their respective terminations.*

We may now consider the importance of these projecting additions to the length of the *ossa humeri*, which almost indicate, that Nature, in meditating the formation of an ulna and a radius, had, from some inexplicable cause, been abruptly thwarted in her design. Though projecting scarcely above an inch, these processes, by more effectually enabling the stumps to come into close junction, convert them into no mean organs of prehension, and supersede the necessity of exclusively using the toes as substitutes for hands. There is also another circumstance to be noticed in the construction of the arms, which has its distinct use:—while the extremity of the right limb is well protected with muscles and cellular substance, that of the left limb, which has been described as a little longer than its fellow, is but

points of the spinous processes of the scapulæ is 7½ inches. Length of the right arm 7⅞ inches; lesser length of the projection ½ inch; greater length 1¼ inch. Length of the left arm 7½ inches; lesser length of the projection 1 inch; greater length 1½ inch. A general notion of the ossa humeri and their appendages, may be obtained by a reference to the engraved outlines of his portrait, which are taken from a finished and well-executed portrait of him by Mr Thomas Hunt of Manchester.

* The mother attributes the loss which her son has sustained from birth to a fall she received during gestation. The labour was a natural one.

thinly covered with an integument of skin. It may be readily conceived what great advantage the boy would take of this peculiarity. Any solid substance which he purposes to carry, is, by the bony and unyielding extremity of the left stump, so pressed against the fleshy cushion that invests the termination of the right limb, as to form for its reception a hollow or bed. By this simple contrivance, substances of almost any shape, whether angular or spherical, are equally well retained in their situation. Nor is the strength and activity with which the lad wields his stumps less worthy of attention; his play-fellows being well aware how able he is to defend himself with them, and how severe a blow they are capable of inflicting. Lastly, in describing the peculiar formation of these limbs, I may remark, that, at their abrupt terminations, there is the same curved or waving configuration of the cuticle, which so peculiarly distinguishes the apices of the fingers; and, consistently with this appearance, the boy affords, on all occasions, the most ample proofs, that the extremities of his stumps are gifted with a sensibility and accuracy of touch, by no means inferior to that degree of delicacy which physiologists have conceived to be peculiar to the structure of the hands.

When I first saw Mark Yarwood, he was actively engaged at a well-known school-game with the boys of his village. He took up a common marble, and with a conjunct motion of the muscles of the arms, seldom failed to hit, with the greatest dexterity, the mark at which he aimed. He has, indeed, the reputation of being the best marble-player in the school. It is, however, evident, that the united effort of the two stumps can, at the utmost, exercise the function of only one hand. The lad's ingenuity is, therefore, continually on the alert in forming devices for the execution of projects, which, in others, require the

active exertions of all the fingers. For instance, when I proposed to him to thread a small needle, he immediately undertook the task, but rendered the labour far less complex and difficult, by previously availing himself of a very artful expedient. After delicately pressing the small instrument between the stumps, he lifted it up, and stuck the point of it into the felt of a hat, so as to fix it steadily in a vertical position. He then directed his attention to the thread: retained it in like manner between the extremities of the stumps; rubbed it with them, as the good housewife would with her finger and thumb, making it taper to a point, and, after this simple preliminary step, the task did not appear difficult to insinuate the silk through the small eye of the needle,—an operation which the lad accomplished on the first trial.

Most of the labours which occupied the attention of Mark Yarwood, were not, however, to be achieved without pressing into service other organs of the body, the natural expedients of the boy being necessarily included in their combined aid. This is, indeed, an inference which cannot fail to arise, when it is kept in view that the stumps, like a solitary instrument of prehension, can, when brought into mutual contact, do nothing more than execute the functions of a single thumb and the four fingers that act as its antagonists. In describing, then, the aid imparted to the *ossa humeri*, when motions were demanded, which in other individuals must require the concurrence of two hands, it may be readily conceived, that the various organs connected with the mouth would be among the most prompt of such auxiliaries. When, for instance, a substance is presented to Mark Yarwood, of such a shape as to require some particular adjustment before it can be taken up, it is, if not too large, first seized by the lips or teeth, preparatory to its being placed on

the surface formed by the soft integuments of the right stump. It is then, as usual, preserved in its position by the pressure of the bony extremity of the left defective limb. The lad was requested by one of my friends to receive a sixpence, purposely exposed before him on the open hand. After placing the extremity of his right arm on the edge of one side of the palm, and with his left limb removing the piece of silver to the position necessary for receiving it between the two stumps, his next object was to transfer the coin to his mouth. Here it was for a few moments retained, until he had inserted one of his stumps within his waistcoat-pocket, which being opened for the purpose very wide, allowed the money to fall into it from his lips. In the operation, however, of tying a common bow, every organ connected with the mouth is employed. As the occasion may require, either one extremity of the string with which the knot is to be made, or the two ends of a double, are fixed between the teeth. That flexible member, the tongue, assumes, by its guidance and gentle pressure, the functions of a finger, being employed to pass one thong under another. This office of the tongue having been executed, either of the two extremities of the string, or either of the two doubles that may have been formed, is caught and retained by the stumps; and when, after one string or double has been received between the teeth, and another between the stumps, it is necessary that they should be pulled in opposite directions from each other, a synchronous and corresponding motion of the head and the *ossa humeri* soon complete the task. All these complex motions incidental to the formation of the knot, are performed with such celerity and adroitness, that it requires the utmost attention to trace the work in its progress.

In many operations, the chin is an organ of no small importance. The lad, in undertaking to stir up the coals

within a common fire-grate, pressed the poker between his stumps at about a middle distance from the extremity of it; he next pressed the head of this lever under his chin, with the view of finding for it a fulcrum. Assisted by this expedient, he easily insinuated the point of the poker between the bars, and, while the defective limbs acted as the moving power, the office was performed with as much agility as it would have been by any individual possessed of both his hands.

On a similar principle may be explained the mode in which Mark Yarwood contrives to feed himself. The handle of the spoon with which he eats, being passed a little way between the coat-sleeve and the arm, is pressed downwards by the application of the left stump; at the same time, the extremity of the handle meets with some resistance in the hollow caused by the short-bending process that terminates the *ossa humeri*, by which means the implement is steadied in its position; it is then plunged into the trencher, and, when filled, is instantly elevated, for the purpose of meeting the lips. Occasionally, however, the boy varies his mode of using the spoon; the stumps secure it by the middle of the handle, while the extremity of the haft is steadied by being pressed against the lower edge of the malar or cheek bone.

But besides calling in the services of the organs connected with the mouth, together with the chin, and even cheek-bone, to aid the stumps, it is easy to conceive that, in so general a requisition, the knees would not be forgotten. Accordingly, these last mentioned organs are very frequently employed to close upon such substances as are of larger bulk than the teeth can secure, or, in reference to their low situation, to otherwise aid the objects which may happen to engage the labour of the stumps. When, likewise, it is considered, that the *ossa humeri*, though fully extended,

cannot reach to the soles of the feet, we shall not be surprized that the feet and toes also should be occasionally called upon to do their quota of duty for their absent brethren, the fingers. Thus, when the lad has occasion to dress, he finds it necessary, before he can insinuate either leg into a stocking, to open the orifice by means of the other foot. This preliminary step being accomplished, he is then enabled by means of his toes, assisted even with the teeth, to drag up the stocking to the necessary height.

Such are the natural expedients resorted to by Mark Yarwood, with the view of obviating a privation, which no one laments less than himself.—"I do not wish to have hands," said the contented little fellow, with much pride and naïveté, "as I have never known the use of them, nor have I ever felt the loss of them."—It cannot be concealed, however, that he is not so entirely independent, as he would conceive himself to be, of the manual offices of the friends by whom he is surrounded. Thus, for instance, in dressing himself, the act of buttoning has hitherto eluded his utmost skill. Yet many of the operations which have hitherto baffled his ingenuity, might be easily surmounted by artificial means, the expence of which, it is to be regretted, his parents can little afford. It may, therefore, be hoped, that the opulent individuals of the neighbourhood in which the youth resides, and by whom the astonishing expedients he uses cannot fail to have been often witnessed, may feel such an interest in his case, as to assist him in increasing those resources to which he has been hitherto most happily prompted by Nature herself.

The last information I have to communicate relative to the case of Mark Yarwood, concerns his education. He was placed some time ago at the National School belonging to the extensive parish of Bowden, with the view of being merely taught to read. But about nine

months ago, he was removed to the neighbouring town school of Hale, conducted by Mr CRAMPTON, under whom he made rapid progress; and the lad is now able, with very little help, to read a chapter in the Bible. The most interesting incident, however, in his education remains yet to be stated. His teacher, a well-informed and humane man, being soon interested in the case of his pupil, whom he found very tractable, and observing how successfully he could find a substitute for hands, soon conceived the possibility of instructing his pupil to write, and the attempt has been crowned with complete success. The manner in which he performs the operation is as follows. The paper is fixed to the table by means of a small weight. The boy first seizes the pen with his teeth, from which, by his own unassisted dexterity, it is lodged, in a proper position, on the soft integuments of the right stump, and retained, as usual, by the pressure of the left; then, by a conjoined motion of both arms, but more particularly by the guidance of the left arm, the pen is drawn along the paper with most remarkable facility. The advancement the boy has made, after a tuition of six months, is very surprising; it rivals, if it do not surpass, the proficiency of such of his comrades as are of equal age with himself, or who have had the same opportunity of instruction.

The Society, in examining the specimen of Mark Yarwood's penmanship, which I beg leave to submit to them, will, no doubt, be of opinion, that, among the various means of which Mark Yarwood has availed himself, to obtain, from his limited means, the effect of operations which have ever been considered as strictly manual, the most important acquirement is that of his being able to write; and, that this art may, under his peculiar circumstances, be so perfected as to render him essential service in his pursuits of life, is a very reasonable anticipation. But

if any doubt exist on this subject, it may be removed by the very interesting case, mentioned in this Society, relative to a German, born in the year 1674, who, to the loss of fore-arms and hands, added even that of the feet. This individual visited Edinburgh about a century ago, and attracted the attention of many scientific men, among whom was Mr Robert Stewart, then filling the chair of the professorship of Natural Philosophy. This is the only account of a privation similar to that of the Cheshire boy, which has come to my knowledge; and I regret not being yet able to find any narrative of the man's habits on record. In the possession, however, of Gilbert Innes, Esq. of Stow, the gentleman to whom the Society has been indebted for this information, there are some exquisite specimens of penmanship, accomplished by this German, with the stumps of the *ossa humeri* alone. With a pen he has very minutely drawn the plan of an air-pump, the solar and lunar systems, and the anatomy of the ear and eye. These sketches, being all contained in the same sheet of paper, have their vacant places supplied with several apposite Greek and Latin quotations, most beautifully written; and the whole being surrounded with an elegant border, executed likewise with a pen. Another production of penmanship, which is on vellum, comprises the Ten Commandments, the Creed, and the Lord's Prayer, written in such fine and diminutive characters, as not to be read without the aid of a powerful magnifying glass. These are, as in the other specimen, included within a very delicately sketched margin.

But to return from this digression to Mark Yarwood.—When I was in Cheshire, his schoolmaster, in a conversation which I had with him relative to the views of life that might be intended for his pupil, conceived that he would scarcely be able to undertake the care of some vil-

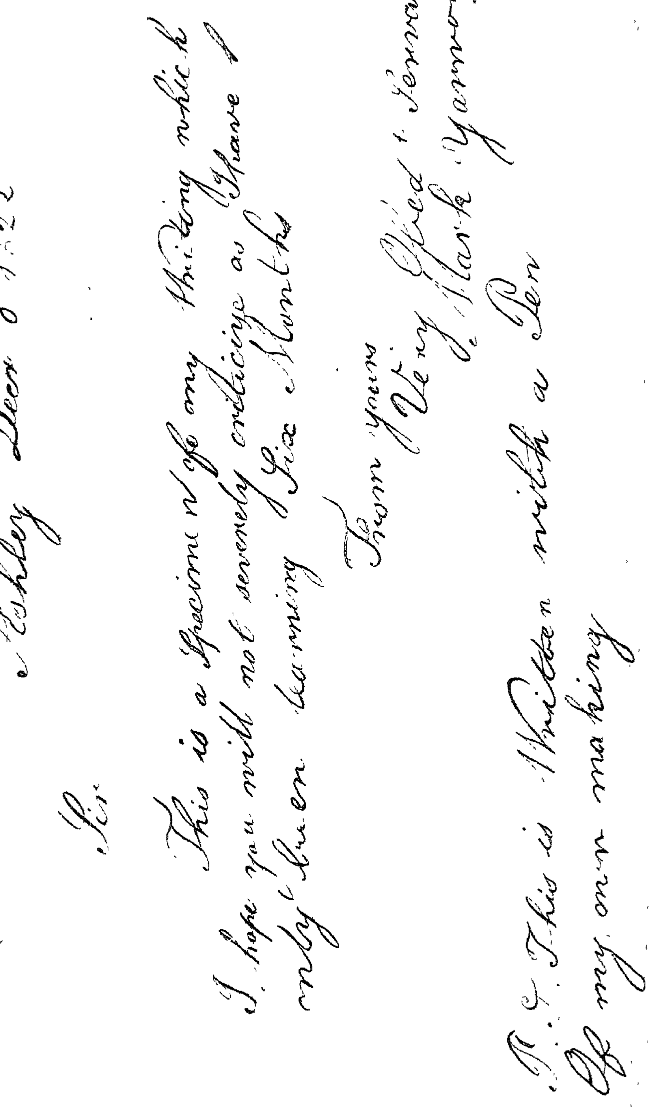
lage-school, as a great obstacle to such a design was his inability to make a pen. This impediment, however, the boy's natural genius has since surmounted; and I have now the pleasure of communicating to the Society the mode in which this process of pen-making is accomplished, as it has been described to me in the letter of a medical friend.* The lad places the quill between his knees, the barrel upwards; then, with a knife held between his stumps, cuts off the end, and, forcing the blade within the barrel, makes the slit. He next cuts away due portions from each side of the quill, the direction of the parings being from below upwards, until a point is formed. He, lastly, places the pen on a flat surface of some hard substance, by which means he is enabled to perform with ease the usual finishing act of snipping off the point. The boy is so proud of this latest acquirement of pen-making, that he has sent me two specimens of his art, and a letter written with a pen made by himself. (See Plate XIV. *for a fac-simile of his writing.*)

I have at length concluded my account of the Cheshire boy, most of the circumstances narrated having been the result of a short conference I had with him, during which period I induced him to perform, by the means in his power, as many manual operations as I could then think of, which, in other individuals, were of the most complex nature†. Since visiting him, however, a few additional trials, which might have been made of his abilities, occurred to me, that would illustrate still farther the expedients

* Mr JORDAN, surgeon, Manchester.

† I was for many days residing at Hale Barns Green, situated within a mile of the place where Mark Yarwood lived, but it was only my good fortune to see him the day before I left the neighbourhood.

PLATE. XIV


Ashley Decr 8th 1822

Sir

This is a Specimen of my Writing which I hope you will not severely criticise as I have only been learning Six Months

From yours
Very Obed.t Servant
J. Mark Yarwood

P.S. This is Written with a Pen of my own making

Facsimile of a letter to Dr. Hibbert from Mark Yarwood, a boy

he had recourse to, in order to compensate for his natural loss. I accordingly requested the assistance of my intelligent and respected friend, Mr JORDAN, surgeon, and lecturer on anatomy in Manchester, whose obliging and efficient exertions I have much pleasure in acknowledging. He was so struck with the various modes in which the lad contrived to remedy the defects of nature, that, for the purpose of completing his observations upon them, he admitted the boy as an inmate of his house for several days. I am thus happy to think, that the case of Mark Yarwood will, in the neighbourhood where he resides, meet with that attention which science, conjoined with humanity, may render of material advantage to the poor lad, in reference to the particular profession of life for which he may be intended. This object, if properly selected, cannot fail to give him much farther opportunity of improving his great natural resources.

I shall not detain the Society with more observations on this remarkable boy, farther than in hoping, that, of the importance of recording such instances of organic privation, there will be but one opinion. To the truly philosophic mind such cases can never fail to be acceptable: the physiologist will learn from them the ample means which a benevolent Providence has afforded to certain individuals, that they may remedy privations from birth, which common opinion has considered as irreparable; he will learn from such sources of information, that whenever the loss, from birth, of any particular organ of the body takes place, certain expedients, from the increased exertions of other parts of the body, will follow, with all the definite certainty which is assigned to a regular cause and effect. It is for this reason, that the record of every varied case of organic privation inseparably connects itself with the natural history of Man.

APPENDIX.

Cases referred to in page 450, of Individuals completely deprived of their Arms from the Shoulder-joints, in which it is shewn, that, under such circumstances, the natural Expedients they made use of, to obviate that loss, consisted in the nearly exclusive use of their Feet and Toes.

Of the first of these cases, I find but a very scanty notice, in a scarce folio work, entitled, "A complete History of the most remarkable Providences, both of Judgment and Mercy, by *William Turner, M. A.*" Under the head of "Wonderful Shapes," &c., there is the following passage: —"We have seen," saith Alexander Benedictūs, "a woman born without arms, that could spin and sew with her feet."

The second case which has come to my knowledge, is that of a woman born without arms, who exhibited herself in England about twenty-five or thirty years ago. She executed with her toes many curious specimens of needle-work, cut out watch-papers, and wrote in a very beautiful style.

The third case was obligingly pointed out to me by a gentleman, as it occurs in the Calcutta Journal of 1st No-

vember 1821. The narrative is so curious, that I beg leave to subjoin it at length.

" *Case of* WILLIAM KINGSTON, *born without arms or hands.*

—" I went to Ditcheat last Monday, and the next morning got him to breakfast with me at Mr GOODFELLOWS. He highly entertained us, by putting his naked feet upon the table as he sat, and carrying his tea and toast between his great and second toe to his mouth, with as much facility as if his foot had been a hand, and his toes fingers. I put half a sheet of paper upon the floor, with a pen and inkhorn. He threw off his shoes as he sat, took the inkhorn in the toes of his left foot, and held the pen in those of his right. He then wrote three lines as well as most ordinary writers, and as swiftly. He writes all his own bills and other accounts. He then shewed us how he shaved himself with his razor in his toes; and he can curl his own hair. He can dress and undress himself, except buttoning his clothes. He feeds himself, and can bring both his meat or broth to his mouth, by holding the fork or spoon in his toes. He cleans his own shoes, can clean the knives, light the fire, and do almost any other domestic business as well as any other man. He can make hen-coops. He is a farmer by occupation. He can milk his cows with his toes; and cuts his own hay, binds it up in bundles, and carries it about the field for his cattle. Last week he had eight heifers constantly to fodder. This last summer he made all his own hay-ricks. He can do all his business of the hayfield (except mowing) as fast and as well with his feet, as others can with rakes and forks. He goes to the field and catches his horse; he saddles and bridles him with his teeth and toes. If he has a sheep among his flock that ails any thing, he can separate it from the rest, drive it into a cor-

ner, when nobody else can; he then examines it, and applies a remedy to it. He is so strong in his teeth, that he can lift ten pecks of beans with them. He can throw a great sledge-hammer as far with his feet as other men can with their hands. In a word, he can nearly do as much without, as others can with their arms.

"He began the world with a hen and chickens; with the profit on them he purchased an ewe; the sale of these procured a ragged colt (as he termed it) and a sheep; and he now occupies a small farm."

The fourth and last case that I have heard of, I extract from a Dumfries paper, dated 10th December 1822, premising, however, that, from personal inquiry, I am given to understand that it is authentically reported.

—"There is at present in Belfast, an ingenious young man, named ROGER BRANAGH, who was born without arms, and is of course devoid of hands, which may be justly classed amongst the most useful members of the human frame. His feet, however, serve him in their place, and enable him to perform various operations, for which, at first view, he would appear wholly incapacitated. He has been seen opening out, with his toes, a closed pen-knife, with which he trimmed a quill, and made an excellent pen, in a very short space of time. He can write rapidly and distinctly, his small letters being well formed, and his capitals cut with taste and ease. It is surprising with what expedition he can thread needles, and even tie a knot at the extremity of the thread with nearly as much facility as the most practised sempstress. He can darn his own stockings, and twist the thread or worsted line which he uses for that purpose to the proper degree of thickness. Branagh can row in a boat with singular energy, though it must be confessed his attitudes are more unique than graceful. On

such occasions he leans his back against the stern, and one foot on one of the seats, so as to keep the oar, which he propels with the other, in due position. With boys he can play at marbles, and clear the ring with remarkable skill, his big toe bulking, as the phrase is, his taw to the mark with the precision of an air-gun. He can convey his food to his mouth with his toes, and is by no means deficient as a carver. Neither is he a timid equestrian, but can even drive a cart or carriage. The reins, on such occasions, are placed round his body, and by moving to and fro, to the right or to the left, he so varies their position as to affect the horse's mouth and direct his motions. This ingenious poor man makes his livelihood by running errands."

XXXIV.—*Notice in regard to the Temperature of Mines.*

By Mathew Miller, Esq. 51st Light Infantry, M. W. S.

(*Read 8th February* 1823.)

THE late experiments on the temperature of mines made in Cornwall, and in other countries, having given rise to various speculations in regard to the distribution of heat in the crust of the earth, all of which appear to me to be unsatisfactory, I now beg leave to offer for consideration of the Society, an explanation, which does not seem liable to the objections that have been opposed to the others.

In every mine, with the exception of a few, which are level-free, the ventilation is carried on by causing the air at the surface to descend, and traverse the works, and then ascend. Now, it is evident, that if a portion of air from the surface be carried down to the bottom of the mine, it will be condensed in proportion to the depth of the mine, and, in consequence of this condensation, will become heated, and the degree of heat will of course be in proportion to the depth of the mine. The air thus heated tra-

verses the works, and imparts its heat to the strata; it then ascends, and is succeeded by a fresh portion of air from the surface, which in the same way becomes heated, and imparts its heat to the strata, and they, in turn, communicate it all around. Thus, in a long course of working in a deep mine, the air at the bottom is heated, and also the rocks to a considerable depth; and when the working ceases, the mine takes a long time to lose its temperature; and this is found to be the case, particularly when the mine becomes full of water, the water being found at first of a high temperature, and gradually to lose its heat, which is in consequence of the strata imparting theirs to the water, and as soon as they have given out all their heat, the water indicates the mean temperature nearly of the place.

The reverse takes place in an old mine when reworked; in that case, the temperature rises gradually as the working continues: and in those mines which are not worked, but in which the ventilation still goes on, I believe it will be found that they do not lose more of their temperature than can be placed to the abstraction of the other causes of heat in working mines, such as that produced by the men, and the lights.

The exact quantity of heat given out by air, in proportion to its condensation, it is difficult to ascertain, but every day's experience proves it to be very considerable; and, I believe, this, added to the other obvious sources of heat in mines in a state of working, will be found sufficient to account for their high temperature.

XXXV.—*Remarks on some of the American Animals of the Genus* Felis, *particularly on the Jaguar*, Felis Onca, *Linn.*

By T. S. Traill, M. D. F. R. S. E. &c.

(*Read 25th January* 1823.)

Among the genera into which Linnæus has distributed the higher animals, none seems more natural, or better defined, than the genus Felis; yet such is the vague descriptions given by most travellers, and by the older naturalists, that we are still in uncertainty respecting several of the species which compose it. My attention has been particularly drawn to this genus, by accidentally meeting with skins, and occasionally with living animals belonging to it, which I have in vain endeavoured to reconcile to the descriptions of authors; and the magnificent collection of zoological drawings in the possession of Lord Stanley, has made me acquainted with several of the feline genus, which do not appear to have attracted the attention of our best systematic writers.

The feline animals belonging to the American Continent are numerous, and have generally been ill-described by naturalists. Indeed there appears to be a singular prejudice respecting them in the minds of many zoologists. Because neither the lion nor the tiger (the monarchs of the forest in the Old World) are found in America, it was a favourite dogma with a celebrated author, that the beasts of prey of the New Continent were inferior in courage and ferocity to those animals of the Old World, which they most nearly resembled. It is true, that none of the beasts of prey of America equal in size and power the lion of Africa, or the great tiger of Bengal: but the jaguar, the puma, and black tiger of South America, equal in courage and ferocity the panther, leopard, and onca, the animals of the other Continents which they approach most nearly in size and habit.

Buffon, and some other writers, have described the jaguar and puma as destructive to other quadrupeds; but as cowardly, and fleeing from the approach of man. It is now well ascertained that Buffon has confounded the true jaguar of South America with the ocelot, a much smaller and less formidable animal; and his account of the puma seems to be taken from the descriptions of those who have only seen the animal in the vicinity of human civilisation. That eloquent writer has admitted the commanding influence of the experience of human prowess in subduing the courage of even his favourite animal the lion. "A single lion of the desert will frequently attack a whole caravan; and if, after a violent and obstinate encounter, he experiences fatigue, instead of flying, he retreats fighting with a bold front to his pursuers. Those lions, on the contrary, who dwell in the neighbourhood of the towns and villages of India and Barbary, being acquainted with man, and having felt the power of his weapons, have lost

their native courage to such a degree, that they fly from the threatenings of his voice, and dare not assail him. They content themselves with preying on small cattle; and will fly before women and children, who make them indignantly quit their prey, by striking them with clubs."

Had BUFFON not been tramelled by a favourite hypothesis respecting the alleged inferiority of the animal kingdom in America, he would have seen that the writers who notice the cowardice of the larger beasts of prey of that Continent, only speak of them as observed near European colonies, where their native ferocity has been compelled to acknowledge the superiority of human intellect and arms. Recent observations have shewn how ill-founded these speculations of the French naturalist have been.

HUMBOLDT mentions many instances of the ferocious courage of the Great Jaguar. Among others, an animal of this species had seized a horse belonging to a farm in the province of Cumana, and dragged it to a considerable distance. "The groans of the dying horse," says HUMBOLDT, "awoke the slaves of the farm, who went out armed with lances and cutlasses. The animal continued on its prey, awaited their approach with firmness, and fell only after a long and obstinate resistance. This fact, and a great many others, verified on the spot, prove that the Great Jaguar of Terra Firma, like the Jaguaret of Paraguay, and the real Tiger of Asia, does not flee from man, when it is dared to close combat, and when it is not alarmed by the great number of its assailants. Naturalists are now agreed, that BUFFON was entirely mistaken with respect to the largest of the feline genus of America. What that celebrated writer says of the cowardly *tigers* of the New Continent, relates to the small *ocelots;* and we shall shortly see, that, on the Orinoko, the real jaguar of

America sometimes leaps into the water to attack the Indians in their canoes."

I am personally acquainted with gentlemen who have hunted the Jaguaret in Paraguay, and who describe it as a very courageous and powerful animal, of great activity, and highly dangerous when at bay. Both this species and the puma are rendered more formidable by the facility with which they can ascend trees. I have been assured by several friends, who have repeatedly hunted the tiger in India, that even this "most beautiful and cruel of beasts of prey," as it is termed by LINNÆUS, generally endeavours to escape from the hunters, unless hard pressed, or surprised in a situation from which retreat is difficult: and one gentleman informed me, that, on a shooting excursion, to his great horror he found himself without a companion in a small field, in which he espied a tiger watching him; that, finding retreat impossible, he advanced against the animal firmly, when it slowly retired, until he had an opportunity of despatching it with his rifle.

Such instances shew that there is no striking difference between the habits and courage of the beasts of prey of the Old and New Continents, as imagined by BUFFON.

While naturalists have been so unjust to the *character* of the American animals of this genus, the forms of these quadrupeds have not been more fortunately delineated in our engravings. For instance; the figure of the black tiger in BUFFON, and in his copyist SHAW, is so wretchedly drawn, and its limbs are so distorted, that not a trace of the genuine form is preserved; but it is considerably better given in the respectable work of PENNANT. The figures of the jaguar and puma, in both the former works, are inaccurate in many respects, especially in the form of the heads, and in giving no idea of the fierce expression of the countenances. The figure of the ocelot, in SHAW, is an

absolute caricature, and conveys no idea of the sprightly motions and strength of this beautiful miniature of the leopard.

These circumstances have induced me to lay before the Society a fine drawing of a very beautiful jaguar from Paraguay*, which was some time ago alive in Liverpool. When the animal arrived, it was in full health, and, though not fully grown, was of very formidable size and strength. The captain who brought it could venture to play with it, as it lay in one of the boats on deck, to which it was chained; but it had been familiarised to him from the time it was the size of a small dog. I did not venture to take measurements of it; but it appeared to be between 6 and 7 feet in length (including the tail), and to stand between 2 and 3 feet in height at the shoulder. The size of the fore-legs seemed very great in proportion to the bulk of the body, and especially of the hind-legs and rump of the animal. The ground-colour is bright fulvous; the fur is short, thick, and glossy, all over the body. It is variegated by long chain-like spots. A chain of such spots passes down the spine from the shoulders to the tail, which consists chiefly of single spots; but some of them are double. On each side of this chain are several rows of open spots, formed by a glossy border of black, including one or more spots of the same colour. As they descend the sides of the animal, these borders become interrupted, and present the appearance of clusters of four irregular oblong spots, with occasionally one or more small central dots. Viewed from above, the back has no inconsiderable resemblance to the

* The drawing was made by Mr Alexander Mosses, a young artist of great merit, who was employed by me for this purpose, and has succeeded admirably in giving the character of the animal.

markings of the shells of some species of tortoise, from the peculiar arrangement of the colours, and the equality of the spaces between each cluster of spots. The face, sides of the neck, and both sides of the legs, are thickly studded with small black spots. The ground-colour of the lower part of the body and inside of the thighs is dull-yellowish white; but the belly is spotted with large, black, irregular marks.

The hair of the tail is not glossy: its upper part is marked with a zigzag pattern, as in the figure; and its lower part is annulated with two or three broad blackish-brown rings, separated by dull yellow stripes. There are two distinct sets of vibrissæ; the first of which are the longest, and are placed two or three inches before the scanty hairs of the other set. The teeth are very large and strong. The whole animal had an appearance of activity and strength, which fully confirmed the accounts of its prowess collected by HUMBOLDT.

FELIS PUMA.

For this animal I would propose the following specific character, which appears necessary to distinguish it completely from *Felis unicolor*, described by me in the third volume of the Society's Memoirs.

Felis, corpore dilutè badio; auribus nigris; caudâ claviformi, apice nigricanti.

Cat, with a light-bay body; black ears; a claviform tail, brownish-black at the tip.

I had an opportunity of inspecting several skins of this animal, the property of Mr EDMONDSTON, who had killed them in the interior of Demerary. None of them were

without the marks indicated in the specific character. The whiskers of all arose from a dark-coloured spot on the face. The blackish tip of the tail measured 5 inches; and, from the length and position of the hairs, made the extremity the thickest part of the tail, or gave it a claviform shape. One of these animals was a female, shot while searching for prey in a lofty tree: its whelp was at the bottom, feeding on a monkey, which had probably been killed by the mother. The young one was also shot. The body of the latter measured, from nose to tail, 2 feet, and the tail 1 foot 1 inch. The upper part of the body was not of an uniform colour like the dam, but it had three chains of blackish-brown spots along its back, with several scattered markings of the same colour on its sides, neck, and shoulders. The crown of the head had several obscure stripes; but the blackish spot at the roots of the vibrissæ, and the black backs of the ears, were very conspicuous. The lower part of the body, and the insides of the limbs, were of a dirty yellowish-grey, with dull-brown bars. These marks disappear in the full-grown animal.

The largest of Mr Edmondston's specimens seemed an animal of prodigious power. It had a much larger head, in proportion to its size, than the figures of Buffon and Shaw; and its canine teeth were enormously large. The dimensions are as follow:

	Feet.	Inches.
Length from nose to tail, - - - - - - - -	4	9
——— of tail, - - - - - - - - - - - -	2	6
Total length, - - - - - - - - - - - -	7	3
Length of the head, - - - - - - - - -	1	0
Circumference of ditto, - - - - - - - -	1	9½
Length of the large canine teeth above the jaw,	0	1¼

Liverpool,
November 1822.

XXXVI.—*Observations on some Species of the Genus* Mergus.

By JAMES WILSON, Esq.

(*Read 22d March* 1823.)

AMONG many recent elucidations of the more difficult points in ornithology, certain species of the genus *Mergus* appear to have continued almost in the same state of obscurity ever since the days of WILLOUGHBY. This has not been owing to the want of zeal or to any negligence on the part of naturalists, because the subject has greatly occupied the attention not only of those who have published on the British ornithology, but of foreign authors. In our own country it has been especially investigated by HEYSHAM, LATHAM, and MONTAGU, although certainly not with any very definite or satisfactory results. The want of success in a matter to which so many acute men have applied themselves, must therefore be sought for in some peculiar circumstances attending the history of the species.

The *Mergus castor*, usually called by us the Dundiver, was described by LINNÆUS as a distinct species. Some

naturalists, his contemporaries, as well as others whose works were published after his death, were inclined to doubt the accuracy of this opinion, rather regarding it as the female of the *Mergus merganser*, or Goosander; yet without bringing forward any positive proof of the accuracy of their own opinion, or of the fallacy of that of LINNEUS. In the thirteenth edition of the *Systema Naturæ*, they are held as distinct; but the many inaccuracies in that edition, as compiled by GMELIN, render it very slightly authoritative in any disputed point. The same opinion, however, being maintained, and its accuracy apparently well illustrated by Dr HEYSHAM, from personal experience and observation, it was received by LATHAM and MONTAGU, and, accordingly, the Dundiver and Goosander are described as distinct species in their respective works. The French naturalists, on the other hand, in conformity with an old opinion of BUFFON's, have recently preferred following the idea of their being the same, and, as such, they are united in the latest Parisian system, the *Regne Animal* of CUVIER. As, however, there are no additional reasons assigned in support of this opinion, nor any facts or series of observations related, from which it may be supposed to have resulted,—those who regarded these birds as distinct, saw no reason to alter their sentiments, or to resign one belief, however unsupported, in favour of another, which was equally so. In short, the matter remained precisely as it was fifty years ago.

In the absence of special facts applicable to any particular species, the history of which we wish to illustrate, I conceive the next safest rule to be, to proceed upon the analogies observable among other nearly allied species of the same genus. As, for example, with the species now under consideration: Two birds, entirely dissimilar in respect to plumage, are alleged to be distinguished from each

other by no *specific* characters, but to differ *in sex alone.* When we observe that the prevailing colour of the one, said to be the male, is black and white, and of the other, said to be the female, ferruginous and lead colour, and when it is not asserted that they have ever been produced from the same brood, or otherwise *proved* to be one and the same, we are certainly authorised in withholding our assent, more especially if our prior belief, however vaguely founded, should have been in opposition to such opinion. If, however, on examining all the other known species of the genus, we should find that the prevailing plumage of the males is invariably composed of black and white, and of the females of ferruginous and lead colour, there would certainly be nothing either rash or unphilosophical in believing, that what was really applicable to those whose sexual characters had been ascertained, was probably also applicable to a solitary species in which they had not been ascertained; and thus, that very difference in the plumage of the sexes, which had induced naturalists to class them as distinct species, would come to be adduced as the strongest argument in favour of their being actually the same.

Such a mode of determining the point in dispute, by referring to the sexual relations in the plumage of other species of the same genus, I conceive to be particularly admissible in the present instance. There seems to be a uniformity of distinction, both in the colours themselves, and in their distribution, as characteristic of the sexes, which strongly marks this genus, and distinguishes it from every other. This sexual distinction in plumage, though almost always perceptible in the species considered singly of other genera, is not, as far as I have observed, perceived to run so distinctly *according to one model*, through a whole group of species, as in the Mergus; and, therefore, any argu-

ment drawn from one species, and applied to another, could not in any other case be so securely relied upon.

It will be perceived that I have adopted that opinion, which maintains that there is no specific distinction between the *Mergus Merganser* and the *Mergus Castor*, but that they form the male and female of the same species; and I think I have done away with any objection in respect to the disagreement in plumage, by pointing out the same distinction, not only as existing in, but as *characterising* the sexes of the other nearly allied species, thus converting it from a specific difference, into a trait of generic resemblance and agreement.

I have examined all the British and French species of the genus, and likewise an American species, called the *Mergus cucullatus;* and in the plumage of these I have found the same sexual distinctions existing as we perceive between the Goosander and the Dundiver, the colouring of the males being like the former, of the females like the latter. It was this general survey, and the uniform sexual contrasts pointed out by it, which confirmed me in the belief, that no specific distinctions were to be found between the *castor* and the *merganser*.

The chief arguments which have been adduced in favour of these birds being distinct, are as follows.

1*st*, The much greater abundance of the *Castor*, or Dundiver, than of the *Merganser*, or Goosander, there being, according to Dr HEYSHAM, from ten to fifteen of the former to one of the latter. Now that the former (regarded as the female) should be much more numerous than the latter (considered as the male), is in perfect agreement with what I should have anticipated to be the case, from the fact, established by many recent observations in ornithology, that these birds (in common with almost all

those which differ essentially in the plumage of the sexes), whether male or female, are fledged whilst immature in the plumage of the female only. In addition to this, the female of another species, the *Mergus serrator*, or Red-breasted Merganser, so greatly resembles the Dundiver in plumage, that it is often confounded with that species in the young state; and as I have ascertained that the young males of the *Serrator* also resemble the females whilst immature, we may see clearly in what manner it happens that individuals in the female plumage are so much more numerous than those in the male; in other words, how the Dundiver should be so much more common than the Goosander. Therefore no good argument can be drawn from this circumstance against their forming one species.

2dly, It has been said that the Dundiver cannot be the female of the Goosander, because, on dissection, individuals of the former kind have been found to be males. It may be answered, that reasoning even on the general law already alluded to, which assigns to the young individuals of both sexes the plumage of the female, whenever there is a marked distinction in their adult plumage, we would be authorised in rejecting such circumstance as in any way conclusive; but it fortunately happens that we are not left in doubt, because one of the specimens before you clearly marks the transition from the female plumage to that of the male. This is very perceptible in the black ring which is forming at the base of the ferruginous portion of the neck, and in the sooty hue which has begun to spread over the brown feathers of the head. There is also an evident commencement, above the scapulary feathers, of that great portion of black which afterwards spreads down the back, and forms the most distinguishing sexual character of the adult male. Lastly, the mature plumage

of the wing-coverts is becoming apparent, that is, the feathers on these parts are changing from lead-colour to white *.

The same circumstance has been observed by LATHAM and MONTAGU in the plumage of the *Mergus minutus*, or little Merganser, so long regarded as a distinct species, but now ascertained to be the female of the *Mergus albellus*, or Smew. Both sexes occurring in the plumage of the female, it was natural enough to suppose that they constituted a species, and that the real adult male was distinct. In like manner, and from the same cause, the error has arisen in regard to the Dundiver and Goosander, although the arguments in the one case are no better founded than in the other. I therefore conceive this latter objection to be as invalid as the former.

In conclusion, I may ask, if the Dundiver is not the female of the Goosander, where are we to seek for it? Although the latter is not an abundant species, it is by no means, in Scotland at least, particularly rare; and, how are we to account for the fact, that we have still to discover the female of a bird, the male of which exists in every cabi-

* The leading distinctions between the plumage of the Goosander and Dundiver are as follows. In the former, the head and neck are glossy greenish-black, the scapularies are black, and the wing-coverts are white; in the latter, the head and neck are ferruginous, and the scapularies and wing-coverts lead-colour. Now, the specimen above referred to, shews, in each of these points, a combination of the plumage of the two sexes; the head being of a sooty brown, the neck ferruginous and black, the scapularies black and lead-colour, and the wing-coverts lead-colour and white. In its prevailing plumage it bears a greater resemblance to the Dundiver than to the Goosander, but its dimensions are those of a full-sized Goosander. It belonged to the collection of the late Captain GEORGE FALCONAR of the Scots Greys, recently added to the Edinburgh Museum.

net in Europe? I have myself no doubt that they are merely different sexes of the same species *.

Having alluded to the resemblance which existed between the plumage of the Dundiver and the female Red-breasted Merganser, I shall add, that the latter, notwithstanding its being considerably less, is frequently confounded with the former, both in foreign and British collections, as well as by systematic writers.

Indeed, I conceive that the only obscure point or desideratum in the history of this genus, is the establishment of a precise and unvarying specific character, by which to distinguish the female of the Red-breasted Merganser from the Dundiver, or female of the *Mergus merganser*. This is a point which, I do not know for what reason, has never been alluded to by any writer on ornithology as a matter of difficulty, and yet none of them has given any character by reference to which such difficulty may, with certainty, be obviated. Knowing the fact that they were *really* distinct, they have disregarded the circumstance that in many instances

* Dr Heysham, and others, have combated the opinion of the Goosander and Dundiver being specifically the same, by referring to the pendent crest which frequently adorns the nape of the Dundiver, an ornament with which the Goosander is more sparingly provided. This mark being, in other crested species, either peculiar to the males, or, when common to both sexes, less elongated in the females, has, therefore, been regarded as a proof that the Dundiver could not be considered as the female of the Goosander. This objection to the identity of these two birds is, however, done away with by the legitimate supposition, that the Dundivers with elongated crests, described by various authors, were not Dundivers commonly so called (by which, of course, I mean the females of the Goosander), but rather the females of the Red-breasted Merganser, the male of which is distinguished by a very fine pendent crest. Such specimens of the Dundiver as were remarkable for their length of crest, when compared with that of the male Goosander, I have always found, upon examination, to be either females or young males, of the Red-breasted Merganser.

they were *apparently* the same; and hence it happens, that, in most collections, it is a matter of chance whether these birds are assigned to the proper species to which they respectively belong. I have been as yet unable to perceive any determinate difference in plumage; and the distinction in size being rather an individual than a specific difference, cannot be safely relied upon, because, as many birds vary in weight and dimensions, according to the season of the year, and their relative condition, where there is not a very great and constant difference in that respect, nothing can be determined by it. I was at one time of opinion, that, in the *Mergus merganser*, and its female the *Mergus castor*, the bill was uniformly deeper at the base laterally, and the nostrils further removed from the frontal feathers, that is nearer the point, than in the *Mergus serrator*. This distinction I believe is general between the full grown and perfectly matured birds of both sexes of these species; but I am in doubt whether it holds good in regard to the younger individuals *.

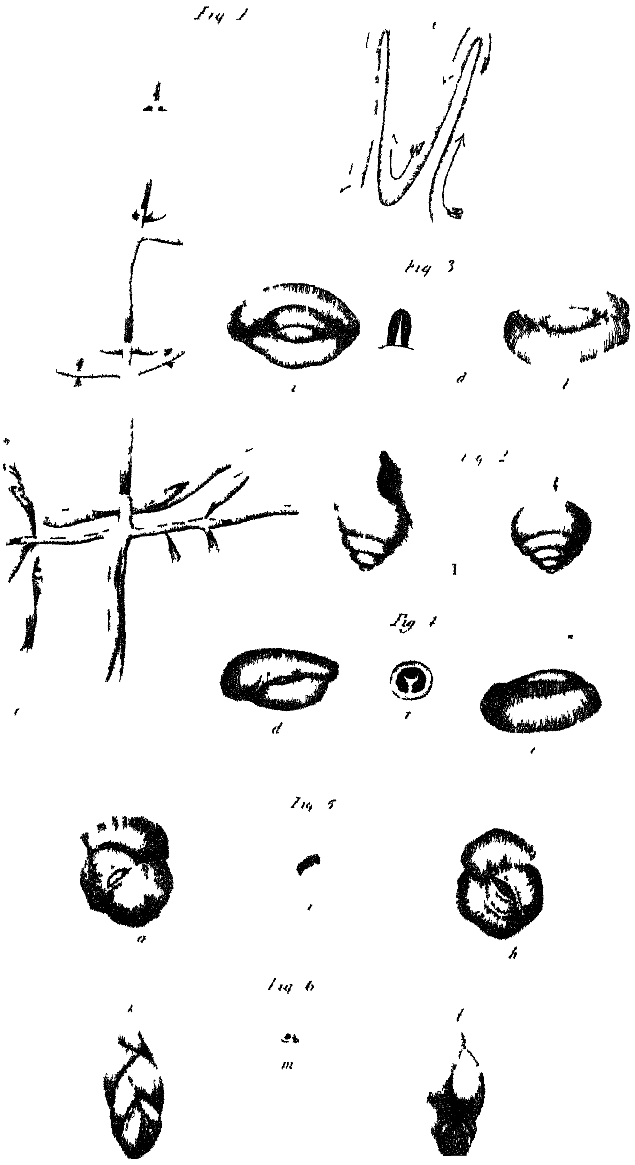
* I am aware of the frequent discussions which have been entered into regarding the structure of the windpipe in this genus, though I have taken no notice of these in the preceding paper, being unwilling to venture upon any thing like anatomical detail, when the points in question can be determined by reference to external characters. I may mention, however, that, notwithstanding the frequent assertion to the contrary, by those who have endeavoured to prove the distinction between the male Dundiver and the Goosander to be founded on anatomical differences, no internal distinction whatever exists between these birds. The apparent difference in the shape and formation of the trachea, and the contradictory statements and erroneous conclusions to which it has given rise, result simply from the circumstance above alluded to, of which anatomists were not aware, namely, the resemblance which the young males and females of the Red-breasted Merganser bear to those of the Goosander. The trachea of the male Goosander possesses two swellings, or enlargements, in its course, besides the

I have thought it right to call the attention of the Society to this difficulty in distinguishing the Dundiver, commonly

bony labyrinth of the inferior larynx; the Red-breasted Merganser possesses only one of these enlargements. It has happened that birds in the plumage of the Dundiver, proving on dissection to be males, and the windpipe being found to be furnished with only one enlargement, the conclusion has naturally enough been drawn, that these birds were the males of a separate and distinct species (the supposed *Mergus castor* of GMELIN), and could not be assigned to any condition of the Goosander. Such specimens, however, had nothing to do with the true Dundiver; they were immature males of the Red-breasted Merganser, and, therefore, prove nothing more than that the young of that species resemble in anatomical structure the adult birds, in like manner as the true male Dundiver resembles the adult Goosander. This view of the subject explains the error in MONTAGU's reasoning on this point. The mistake seems to have originated in the Berlin Transactions; in the third volume, tab. 7. fig. 5, there is a drawing of the trachea of the Dundiver; and in the fourth volume of the same work, tab. 18. fig. 3, there is another of that of the Goosander; the former with one enlargement, the latter with two. Mr SIMMONDS, on the contrary, (Linn. Trans. vol. viii.), who dissected these birds, with a view to this disputed point, asserts that there is a perfect agreement in their internal structure; and the same opinion is maintained by M. TEMMINCK in his "Manuel d'Ornithologie." These seeming contradictions are easily reconciled, by bearing in mind the close resemblance which exists between the plumage of the immature males of the Goosander and Red-breasted Merganser, and the consequent liability of their being confounded by the dissector. Those who still entertain any doubts on the subject, may easily satisfy themselves in this quarter of the island, where both kinds are sufficiently common. When a male bird, in the plumage of the Dundiver, is observed on dissection to have two enlargements in the course of the windpipe, it may then be considered as the young of the Goosander (*Mergus merganser*); when only one such enlargement is perceptible, it may safely be regarded as an immature Red-breasted Merganser (*Mergus serrator*). The difference in the bill, as mentioned in the text, will form, it is hoped, a more important external character of distinction than any previously pointed out. In regard to the title of *Mergus castor* (the bird indicated by it being an imaginary species), it should of course be erased from the list of specific names.

so called, from the female of the Red-breasted Merganser, because it has been hitherto entirely overlooked by ornithologists. If kept in view during future examinations, by such of our members as devote their leisure to the elucidation of ornithology, I have no doubt it will speedily receive sufficient illustration.

PLATE XV



XXXVII.—*Observations on the* Sertularia Cuscuta *of* Ellis; *with a Figure.*

By the Rev. John Fleming, D.D. F.R.S.E. M.W.S. &c. Minister of Flisk.

(*Read* 8*th March* 1823.)

There are many objects in the animal kingdom which baffle the exertions of naturalists to determine their characters. They are seldom met with even by those who are indefatigable in their researches, or, when secured, they are not in a condition calculated to furnish satisfactory results. These remarks apply in all their bearings to the *Sertularia Cuscuta*. Mr Ellis, the well-known author of the "Essay on Corallines," examined the Zoophytes of the British shores with the most persevering industry, visiting, at different seasons of the year, various parts of the coast, and receiving from correspondents the productions of those districts which his circumstances did not permit him to explore. Yet, with all these favourable opportunities, the present Coralline seems to have occurred to him in such an imperfect state, that he was unable to detect even the

remains of the pulpy matter of the polypi, and could only describe and delineate the sheath or protecting case.

Succeeding naturalists, who have attached themselves to the study of zoophytes, seem to have been equally unsuccessful, in reference to this species *. PALLAS, in his "Elenchus Zoophytorum," borrows his characters from the imperfect description of ELLIS, and seems disposed to consider the subject as belonging to the vegetable rather than to the animal kingdom: "Structura etiamnum obscura; et quo magis examino, eo magis *confervis* potius quam Sertulariis adnumeranda mihi videtur." P. 125.

M. LAMOUROUX, the author of the "Histoire des Polypiers Coralligenes Flexibles," appears to have had an opportunity of examining this species; but in his description he adds nothing to the characters previously assigned to it by ELLIS, excusing himself, on account of the difficulty of examining so small an object. He adds, in a note, "Ce Polypier doit former un genre particulier, mais il m'a paru si difficile à définer, que j'ai préféré me borner à l'indication plutôt que de mal characteriser; il est presque impossible de le bien observer à cause de sa petitesse; cependant j'ai essayé de rendre dans la phrase specifique de cette Sertulariée, le peu que j'en ai vu." P. 198.

* Since the observations in the text were sent to the press, I have had an opportunity of consulting the "Zoologia Danica," vol. iii. p. 62. tab. cxvii. f. 1. 2. 3. (middle), where there is a description and figure of this species by ABILDGAARD, taken from luxuriant specimens found in the Baltic. The figures are good, and the description has been drawn up with considerable care. The author notices the axillary mode of growth, but he has failed to record his observations on the internal structure of the body. He states the tentacula as 12 in number. In the course of my observations, 8 tentacula only were perceived; and, as I particularly directed my attention to this subject, and exercised considerable caution in the enumeration, I am disposed to consider the number fixed on by ABILDGAARD as exceeding the truth.

Last spring I had the good fortune to find a small tuft of this Sertularia, which had been left on the beach by the tide, in the Frith of Tay, and at this place (Flisk), where the water is only brackish. Upon placing it in a glass of the Tay water, strengthened by the addition of a little salt, for the purpose of inducing the parasitical rotiferæ to expand (having frequently observed that these were more vivacious than the corallines which they infest), I was glad to find the Sertularia itself in a living state, the polypi speedily issuing from their cells, and enabling me to make some interesting observations.

In this Sertularia several *stems* usually proceed from the same base; these are filiform, jointed, and slightly waved, and support all the branches and denticles in opposite pairs, and on the same plane. They maintain their primary rank throughout.

The branches occur in pairs, rather remote, placed opposite to each other, and proceeding from the stem nearly at right angles. The joints on the stems occur immediately above the insertion of the branches.

The denticles or *cells* are oval, sessile, and upwards of ten times the breadth of the stem. In general, they occur in pairs, at remote distances, on the stem or branches, projecting nearly at right angles; and are probably ultimately converted into branches, when no longer necessary as an integument to the polypi, as I have observed take place in the Sertularia *gelatinosa* of PALLAS *. Sometimes they occur in the axillæ of the branches, in pairs, or in greater numbers, crowded together.

The *polypi*, when expanded, project considerably beyond the mouth of the denticle, as at *a*, Plate XV. fig. 1., with

* Edin. Phil. Journ. v. ii. p. 86.

the margin of the aperture of which, their skin has a perfect continuity. When in a state of rest or contraction, they are doubled in the cell, as exhibited at *b*, and its margin in this state is obviously inflected.

The *arms*, or tentacula, are nearly cylindrical, and limited to the number of eight.

In some Sertulariæ which I have examined, the arms seemed furnished on all sides with suckers, analogous to those of the cuttle-fish. On the arms of this species, however, I detected a very different arrangement, and one which I suspect has not hitherto been noticed. Each arm is furnished, laterally, with a row of short hairs or plates; for the highest magnifier which I could conveniently apply did not enlarge the object above a hundred diameters, and was incapable of enabling me to determine their true shape. The motions of these hairs, were, in consequence of the currents which they produced in the water, sufficiently obvious. The hairs, on one side of the arm, exercised a continued motion, so as to cause the water to flow from its base to the extremity; while those on the opposite side executed a motion the very reverse of this, causing the water to descend from the extremity of the arm towards its base. And again, if the hairs on the right side of one arm were fitted to cause the water to ascend, the hairs on the left side of the contiguous arm were found suited to produce a current in the opposite direction, as exhibited (not from nature, but to render the description intelligible) at *c*, fig. 1. Plate XV. Analogous hairs exist on many species of Medusæ, Tritoniæ, &c. in which they are obviously unconnected with the digestive system as assisting prehensible organs, and may probably be considered as forming a part of the aërating organs. In this Sertularia, their occurrence on the arms, which are true prehensible organs, and belonging to the digestive system,

may induce a belief that they are merely parts of that system, and destined by the currents which they produce, to bring the small animals, their prey, more easily within reach of seizure. The currents, however, which are produced by their motion, seem better calculated for bringing fresh portions of water in contact with the sides of the arms, than to bring animalculæ within the space which they surround. They may possibly be destined to act as organs of touch, though I am rather disposed to regard them as *branchiæ*, placed in the most favourable position for receiving the influence of the oxygen of the water.

In that part of the body of the expanded polypus, situate towards the middle and bottom of the cell, I observed a pale-coloured organ with darker matter both above and below. This organ was frequently in very rapid motion, by means of which portions of the dark matter beneath were brought up and added to that which was above the organ, or portions abstracted from above and carried beneath. The portions of matter moved were not unlike grains of sand, which had probably been taken in along with the food.

The small egg-shaped bodies in some parts of the branches, which were regarded as vesicles or ovaria by Ellis, are merely the rudiments of young polypi. It is probable, however, that, after having served the purposes of polypi, they may be changed into ovaria. This is a metamorphosis which takes place in some of the other kinds of Sertulariæ, and is not more surprising than the conversion of the cell and its polypus into a branch, as I have elsewhere observed. We are apt to consider these animals as simple in their construction, possessing few organs, and exercising very limited functions; and, when they are compared with the Vertebral tribes, the opinion is perhaps well founded. But we may carry this view too far, and,

by regarding the fresh water species of Hydræ, which are very simple animals, as the type of the group which includes the Sertularia, rest satisfied, that all that is singular in their construction, has been detected by the acuteness of Ellis, and thus neglect a field of investigation, not more rich in elegant forms, than in variety of structure and function.

I may add, that the *Sertularia cuscuta* and *S. uva* agree in the remarkable character of having *only eight tentacula,* and in the ovate subsessile denticles. The former is placed by M. Lamouroux in his genus Sertularia, while the latter forms a part of a very motley group, which he terms Clytia. Neither of these species, however, can be considered as belonging to the genera in which they are classed, since they differ from the characters by which these genera are distinguished. It is my intention, in a synopsis of British animals which I am engaged in preparing for the press, to constitute these two species into a new genus, and by naming it Walkeria, consecrate it to the memory of the late Dr Walker, Professor of Natural History in the University of Edinburgh. Known, as he was, to several members of the Wernerian Society, as profoundly versed in all the departments of natural history, and extolled as he has been, in the sketch of his life which has been communicated to the Society by his meritorious successor, the present compliment to his name may be deemed insignificant. Perhaps it is so; but I have been led to pay it, from having had an opportunity of judging of his intimate acquaintance with the tribe of zoophytes to which this group belongs, by inspecting a collection of specimens of various species of Sertulariæ, which he had collected on the Scottish shores, and arranged and named. These have exhibited numerous proofs of his zeal, his knowledge, and his sagacity.

On several parts of the stem of this Sertularia I observed a Vorticella, which I had not met with before, and which is not figured in the invaluable work of MULLER on Infusory Animals. It is more nearly related to V. *citrina* of that author than to any other; but its composite nature, and dark internal medullary matter, form sufficiently marked characters. It continued always fixed; otherwise, had it been a free animal, with caudal claspers, I should have traced its affinity to the V. *senta* of that author, and to the genus Furcularia of LAMARK. It may be termed Vorticella *coalita*. The annexed figure (Plate XV. fig. 2.) will convey an idea of its characters.

MANSE OF FLISK,
February 15. 1823.

XXXVIII.—*Remarks on the* Guanaco *of South America.*

By Thomas Stewart Traill, M.D. F.R.S.E. &c.

(*Read 8th February* 1823.)

Many authors have described four animals inhabiting South America, the *Llama*,* *Vicuña*, *Paco*, and *Guanaco*, as distinct species: but there appears so much confusion in their descriptions, that there is every reason to conclude they have mistaken the effects of domestication for specific differences. Cuvier has followed Pennant in considering the Llama as the domesticated Guanaco, and the Vicuna the tamed variety of the Paco. This point has probably been illustrated by the researches of the indefatigable Humboldt; but never having had the good fortune to see the zoological portion of his splendid work, I am unable to state the opinion of that illustrious traveller.

* This is the Glama of Shaw, and other writers, who appear not to have been aware of the force of the *Ll* in Spanish. It has the sound of the Italian *Gl* in the word *figlio*. The ñ in Spanish, has the sound of *Gn* in the Italian word *ignudo*.

While there appears much confusion in the descriptions of our systematic writers on this subject, their engraved figures seem to be little calculated to aid our conceptions of their forms.

Several living specimens have been, at different times, brought from South America to Liverpool, under the name of *Guanaco;* and I availed myself of the opportunity to procure an accurate drawing of one from the pencil of Mr Alexander Mosses, a very promising artist of this town. The animal is represented in profile, and its head, of which the expression is very peculiar, is drawn in front. The following description was drawn up on September 23. 1819, from two living animals, one of which is represented in the drawing. (Plate XVI. fig. 2.)

Camelus Guanaco.

Char. specific.—*Camelus pilis lanosis, confertis; dorso arcuato; cruribus posterioribus maculo nigrescenti acutè elliptico utrinque distinctis; caudâ pendulâ.*

Camel with thick set woolly hair; an arched back; the hind legs marked, on both sides, by an acutely elliptical, blackish spot; tail pendulous.

Description. The general colour of the animal is a russet-brown above, and an ash-grey passing into greyish-white below. The head is fawn-coloured, which is deepest on the nose. The upper part of the neck, the shoulders, and back, have a pale russet-brown hue, dashed with a purplish tint, which is most discernible on the shoulders. The lower jaw, chin, throat, belly, outside of the lower part of the legs, are ash-grey; the inside of the legs, and middle of the belly, are greyish-white. The fur is thickly

set on the head, neck, and upper part of the body: it is woolly on the back, flanks, and tail; but its length is not above two inches on any part of the body, except at the extremity of the tail, where it is nearly three inches long. The belly and inside of the upper part of the legs are nearly naked. The hair on the lower part of the limbs is very short, and sleek; and the whole coat of the animal is extremely soft.

The upper lip is bifid; the *sulcus* is moist; peculiarities which become very apparent when the animal is eating. The structure of the upper lip gives it very considerable power in collecting the food. The sides of both lips appear wrinkled; their edges thick. The tip of the nose is covered with hair like the rest of the face. The nostrils are oblong. The eyes are of a deep-blue, and have a very mild expression, like those of an antelope: they are furnished with long, silky, black eye-lashes, and there are long hairs of the same colour in the supercilia. The face suddenly contracts below the eyes, though the muzzle is not very acute. The forehead is broad: the ears are very long, and often in brisk motion, though generally erect.

The neck is long, slender, and cylindrical, and is generally arched into a graceful curve: it springs *easily* from the chest, without shewing any abrupt curve. The animal has vast command over this part, and can readily turn its head over its rump, without moving the limbs. The hair on the neck is remarkably woolly, and soft, but very short. The arching of the back is very considerable: the shoulder is lower than the rump: the circumference of the loins is slender. The tail was either observed to be freely pendulous, or to be pressed down over the *anus* when the animal dreaded any thing. The under side of the tail is provided with long whitish hair, which hangs down below its tip.

The limbs are very slender, like those of the antelope: the posterior extremities are longer than the fore-legs; hence the animal in running proceeds by vast bounds. On the fore-legs the tawny fur descends below the carpus, or what is commonly called the knee of quadrupeds; but on the posterior extremity, it does not reach the corresponding joint by three inches. The spot mentioned in the character occurred in all the specimens of this animal which have fallen under my observation, and had, in all, the same form and colour. Its hue is deep chocolate-brown, when narrowly examined, or almost blackish-brown: it lies in the space between the bone and the strong flexor tendons: its form is acutely elliptical. The exterior spot is larger than the interior. The former was 2 inches long, and ½ an inch broad at its widest part.

The foot of this animal is singularly formed. The division extends up to the first joint of the leg; yet the sole is very flat, and the *sulcus* apparently small, when seen from below. The soles of the feet are furnished with *callus*, of an elongated form, and slightly rounded at the extremities. The hoofs are very small, and rather resemble nails or claws, forming triquetrous coverings to the extremities only of each toe, with the acute edge towards the inner and upper part, being quite open below, and projecting beyond the end of the toes in a sharp point. This is the structure of both feet.

The habit of the animal resembles that of some of the more slender antelopes. The limbs are long, and convey the idea of great fleetness. Its manners appeared gentle; yet, when irritated, it turned its head round, and, by a forcible expiration, projected its saliva, in small quantity, at the object of its dislike. The Spaniards assert, that the saliva, thus projected, has an acrid quality, slightly inflaming the skin where it alights, and producing some itching.

This I cannot either affirm or deny from personal observation; but the sailors of the ship which brought some of these animals to Europe, asserted the same story.

When the Guanaco rests, it gathers its legs below it, bending the knees, so as to fold the fore-legs directly under the breast, and reclines on the centre of its breast and abdomen.

The specimens brought to Liverpool fed on hay, from which they selected the moister portions. On their arrival they would not taste oats, though they seemed fond of barley; a preference, no doubt, owing to their *Spanish education:* for the horses and mules of Spain will not eat oats, when they can obtain barley. The Guanacoes seemed fond of apples, but would not eat cabbage. They were tame, and gentle; seemed to love being caressed by those who approached them, and smelt their hands and clothes; but were impatient when their mouths or ears were handled. They occasionally uttered a faint sound or groan when much teased, and usually accompanied this with a hissing ejaculation of saliva.

The following are the dimensions of the Guanaco:

	Feet.	Inches.
Length from the tip of the tail to the end of the nose, along the curvature of the back and neck,	5	5
Height at the shoulder, - - - - - - - - - -	2	11
——— at the haunch, - - - - - - - - - -	3	2
Circumference of the body at its widest part, -	3	4
Length of the head, - - - - - - - - - - -	0	11½
Breadth of the head over the eyes, - - - - -	0	5
Gape of the mouth, - - - - - - - - - - -	0	2½
Length of the ears, - - - - - - - - - - -	0	5
——— of the eye, - - - - - - - - - - -	0	2
——— of the neck, - - - - - - - - - - -	2	0

	Feet.	Inches.
Circumference of the neck, - - - - - - - - -	1	0
Length of the division of the upper lip, - - -	0	1
Breadth of the chest, - - - - - - - - - - -	0	9
Length of the tail, to the end of its hairs, - -	0	8
——— of the fore-leg, from the joint of the scapula, - - - - - - - - - - - - - -	2	1
——— of the hind-leg from the hip-joint, - -	2	6
——— of the cleft of the foot from the point of the toe, - - - - - - - - - - - - - -	0	4½
——— of the callus of the sole of the fore-foot,	0	3½
——— of a hoof of that foot, - - - - - - -	0	1

LIVERPOOL,
November 1822.

XXXIX.—*On a Reversed Species of Fusus,* (Fusus retroversus.)

By the Rev. JOHN FLEMING, D. D. F. R. S. E. M. W. S. &c. Minister of Flisk.

(*Read 5th April* 1823.)

IT is well known to British conchologists, that sinistral, or reversed spiral shells, are of frequent occurrence among the terrestrial and fluviatile mollusca, while they are seldom to be met with among those which inhabit the sea. Extensive genera, indeed, occur in the former groups, in which all the species exhibit reversed whorls, not as a monstrosity, but as a permanent feature. The genera Clausilia and Vertigo, in the terrestrial, and Physa, Aplexa, and Planorbis, among the aquatic *pulmonifera*, are striking examples, and embrace about twenty indigenous species.

Among the marine spiral shells belonging to the branchiferous mollusca, those with sinistral whorls are of such rare occurrence, that not more than one species in a genus has yet been detected. In the British Fauna, only two species have hitherto been recorded among the recent kinds, viz.

the *Murex adversus* and *Voluta heteroclita*, of MONTAGU'S "Testacea Britannica." The addition, therefore, of a third reversed species, cannot fail to interest the British conchologist. The following description, with the accompanying magnified drawing, (Plate XV. fig. 2.), which exhibits a front and back view, will, we trust, sufficiently establish its characters.

Shell with five rounded whorls, well defined at the line of junction. These increase somewhat rapidly in size, and, being a little depressed, give to the shell what is termed a *bellied appearance*. The mouth is oblong, placed obliquely, and interrupted by the convexity of the body-whorl. The outer lip joins the body-whorl at an acute angle. The pillar is straight, and slightly scooped out at the apex for the canal, which is shallow, regular, and short.

The whole shell is smooth, glossy, and so transparent as to permit the pillar to be distinctly perceived throughout its whole length. The layers of growth are scarcely perceptible even when highly magnified. The whole shell scarcely exceeds a line in length.

Three specimens of this shell have occurred to us in shell-sand from Noss Island, Zetland, which we collected after a storm in the spring of 1809.

None of the characters of this shell would lead us to consider it as the young of any of the larger species. The relative proportion of the different whorls, and their number, intimate that the shell is nearly at its full growth, or, at least, that it has assumed its true form. Had any doubts remained on this subject, we would not have offered the preceding description, as we are aware, that fry of several shells hold the rank of species in the systems of British conchologists.

This shell belongs to the section of the genus Fusus distinguished by the absence of a pillar-cavity, and which

is known to include the Murex *despectus* and *corneus* of British writers, as examples.

In this section, it will form a group along with the Murex *contrarius* of SOWERBY's Mineral Conchology, vol. i. p. 63. tab. xxiii., distinguished by the whorls being reversed. Perhaps they might constitute a new genus, to be denominated *Heterofusus*. The Murex *contrarius* (now before me), which is found in gravel-pits in Essex and Suffolk, and which is considered as *extinct*, differs from the recent one, which we have described, in size, and in the shape of the whorls, the mouth, and the pillar. Our species, indeed, acquires considerable interest from this circumstance, that it is the only known representative of a tribe, inhabiting our seas at present, the Murex *contrarius* having probably flourished when the seas of Europe were peopled with a different series of molluscous animals.

MANSE OF FLISK,
February 21. 1823.

XL.—*Notice of a Specimen of the* Larus eburneus, *or Ivory Gull, shot in Zetland; and further Remarks on the Iceland Gull.*

By Laurence Edmondston, Esq.

(*Read 8th March* 1823.)

LARUS EBURNEUS.

I AM not aware that any individual of this very beautiful species has been hitherto noticed as occurring on the British coasts. The specimen now exhibited to the Society was killed in Baltasound, Zetland, on the 13th December last. It was remarkably lean, weighing only 10 ounces. The length is 16 inches, the breadth 3 feet 3¼ inches. The irides are stated by many ornithological writers to be brown; by others, as Fabricius, black: in this individual, however, they were of a pale lead colour. The bill is bluish-black at the base, gradually becoming paler towards the point. Feet and legs black; four toes, the hind one being very distinct: claws black, large, and tolerably sharp and hooked. The tibia naked a little above the knee. The skin is throughout covered by a profusion of remarkably

thick, fine white down. The ground-colour of the whole plumage is of a delicate glossy ivory-white (as the name indicates), with brownish-black circular spots dispersed through it; these are very sparingly distributed on the back and lower part of the body; most numerous on the wing-coverts and scapulars: the tail and primaries tipped with the same colour: the throat is mottled in a similar manner: the dusky spots are, however, of a paler shade, running more into each other. The forehead and space between the eyes and bill, lead-colour. The tail consists of only eleven feathers, but this may be accidental. Its sex was very distinctly male; and I should be disposed to consider it a bird of the second year *.

This species in its adult summer-plumage is of a snowy whiteness, and in this state has been often and accurately described by many naturalists. I do not, however, find any account of its winter-dress, or whether, during that season, it assumes a similar change of colour about the head as its congenerous species.

Fabricius, in his *Fauna Grœnlandica*, states, that it generally keeps out at sea, seldom approaching the land; "et tunc admodum incautus, ut facile occidatur." It is little fastidious in the selection of its food, and very voracious, feeding chiefly on carrion. The voice is harsh and strong. The mode of breeding seems not to have been ascertained. It is peculiarly an arctic bird, inhabiting chiefly Spitzbergen, and the highest northern latitudes.

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* Meyer describes a second year's bird having the characters here stated. Meyer's specimen, however, was killed in March.—Edit.

ICELAND GULL.

In my earlier observations on this bird, I had adopted the opinion of two species existing, to which this name was in common applied in Zetland; the one having to the other a relation analogous to that which exists between the Greater and Lesser black-backed Gulls. This opinion was founded chiefly on the great inferiority of size; greater elegance and delicacy of form; the different markings of the plumage, and the livelier and more active habits—of the smaller variety. But as I had never quite assured myself of having seen it in its mature plumage, and very seldom, till lately, having fallen in with even the young, I was rather inclined to believe, that what I had conceived to be a new species, was merely an accidental variety, or the result of my own inaccurate observation. Last spring, however, I had an opportunity of satisfying myself of the correctness of my first views, by obtaining possession of an individual of this species; it was killed in Baltasound in April last; it was a female, though the sex was not very conspicuous.

This specimen, which was a very interesting one, and in a stage of plumage exhibiting very aptly the young and adult appearance, was sent off from Zetland, last October, to this city, for the inspection of the Society; but the vessel by which it was forwarded, has been unfortunately lost. Its size was rather smaller than that of the female Herring-Gull, while the Great Iceland Gull, described in the last part of the Wernerian Memoirs, is often larger than even the Larus Marinus. The primaries were white, still, however, retaining on their exposed edges the slight livid hue characteristic of the immature young. The under part of the body was white; the wing-coverts, scapulars,

and head, tinged with blue and ashy colour, of a paler shade than what occurs on the same situations in the larger species. The bill was smaller than even that of the Herring-Gull. The irides were evidently in a state of change, and of a dingy yellow colour; the back was very pale blue: in other respects it was similar to the greater species of the same name. A specimen is exhibited, of what I conceive to be one of these birds in its first year's plumage, which will illustrate some of these remarks. The difference of size, especially of the bill, will appear very striking. The general brownish ash-colour of the plumage is also paler than in the young of the larger species of equal age; and the dingy spots occasionally occurring on both are, in the Lesser, fainter and less numerous. It is precisely by such analogous differences alone, that the young of the other species of gull are distinguished from each other. This individual was also killed in Zetland, but its sex could not be determined. These Lesser Iceland Gulls are much more rarely met with than the Larger, with which they do not appear often to mingle; but when seen accidentally together, the difference of size and general appearance seems very obvious. The mature plumage I believe to be almost the same as that of the Greater Iceland Gull, or *Larus glaucus* of PENNANT's Arctic Zoology, and of LATHAM; and in this state it would agree precisely with the *Larus argentatus*, or Silvery Gull of the same authors, and also of BRÜNNICH, and the older northern naturalists.

TEMMINCK, in his very able and accurate work (*Manuel d'Ornithologie*), seems to regard the *Larus argentatus* as a mere variety of the Herring-Gull, and has transferred its name to this latter species; considering the variety, which he regards as chiefly consisting in the white colour of the tips of the primaries, as the result of a residence in an arc-

tic climate*; but this opinion appears partial and hypothetical.

The summer-plumage of the Greater Black-backed Gull, of the Razor-Bill, and Black Guillemot, and other water-birds common to the arctic and temperate climates, is the same in whatever region they are met with; yet the plumage of the Lesser Iceland Gull remains at this, as at every other season, quite distinct from that of the Herring-Gull.

There is no instance of the Iceland Gull breeding in Zetland that has ever come to my knowledge, though in that country the Herring-Gulls are remarkably numerous. The habits and general aspect, the size and shape of the bill, the voice, mode of flight, shape of the wings, are all different; nor does it attempt to alarm other birds on the approach of the sportsman, a quality for which the Herring-Gull is so remarkable. The young of each are also equally distinct.

It will also be borne in mind, that I had formed the opinion of two species of Iceland Gull as early as the year 1809; and in 1814, had sent a specimen, and full description of the greater species to the London Museum, before I had heard of such a name as the *Larus glaucus* or *argentatus*, or any other synonym of these two species, whose existence and description by the older ornithologists, were till recently forgotten, or only obscurely and indefinitely remembered. It was not likely that my impressions were biassed by the opinions of others, when, from remoteness and peculiarity of situation, my ornithological library was confined to a book or two on *British* birds, and my museum to the precipices and heaths of Zetland.

* See Captain SABINE's paper on the birds of Greenland, published in the Linnean Transactions for 1818.

If this species be to be identified with any of its congeners, the Large Iceland Gull is that to which it is most assimilated; but the reasons that induce me to reject this supposition I have already detailed. It therefore appears to me that there does exist a Lesser as well as Greater Iceland Gull, as we have a Greater and Lesser black-backed Gull.

According to the celebrated naturalist before quoted (TEMMINCK), the Large gulls are thus named: *Larus marinus*, Great black-backed Gull; *L. glaucus*, (fully described by me under the name of Iceland Gull); *L. argentatus*, the Herring-Gull. *L. fuscus*, is the Lesser black-backed Gull. An appellation is therefore wanting for the Lesser Iceland Gull; and the one of *Islandicus*, which, for the sake of precision, I proposed to apply to the Greater species, may be transferred to the Lesser, as perpetuating the only distinct vernacular name which they appear to have received, and by which they have been long accurately known to the fishermen of Zetland *.—"Souvent le peuple, qui voit sans le prestige des systemes, observe mieux que nous, qui ne voyons quelquefois que ce que nous cherchons à croire d'apres l'opinion que nous nous sommes preliminairement formé."—(BICHAT.)

EDINBURGH,
February 9. 1823.

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* It thus appears that the young of the Lesser Iceland Gull is the *Larus glaucoides* of TEMMINCK; the old bird, the *L. argentatus* of BRÜNNICH.—EDIT.

Since this paper was read to the Society, I have fortunately had an opportunity of examining an adult specimen of the Lesser Iceland Gull, which was killed in the Frith of Clyde about two months ago; and it satisfactorily confirms what I have stated regarding the general appearance of the species. The back and upper wing-coverts are very pale blue; all the rest of the plumage is white, except the head and upper part of the neck, which are streaked with grey, as occurs in the winter-dress of the other large gulls. Wing-feathers and scapulars are tipped with a more brilliant and pure white tinge than that which occurs on the rest of the plumage. The breadth 4 feet 4 inches, length 22 inches; iris pale yellow; bill smaller and more slender than in the Herring-Gull; feet deep-flesh colour; toes four. This interesting specimen I met with in the rich zoological cabinet of my highly respected friend Charles Edmonstone, Esq. of Cardross Park.

XLI.—*Observations on the Formation of the various Lead-Spars.*

By Mr JAMES BRAID, Surgeon, Leadhills;

Contained in a Letter to CHARLES ANDERSON, M. D. M. W. S. &c. Leith.

(*Read 5th April* 1823.)

DEAR SIR,

IT is more than four years since I first hinted to you my opinion regarding the formation of the different lead-spars found in the mines here; and now, after various opportunities of repeating my observations on the same subject (which confirm the opinion then stated), I most readily comply with your late request, of communicating to you my ideas on the subject, in a more extended and perfect form, than then given.

I had not resided long at Leadhills, before the appearances presented by the various spars of lead found in the mines,—the nature of the situations in which they most generally occur,—and the peculiar circumstances which en-

able such as are conversant with mining operations, to guess at those situations which are likely to abound with them in greatest perfection, attracted my notice, and led me to bestow some share of attention on the subject. I was soon induced to think that the galena was the first formed of the minerals occurring in this neighbourhood, and that all the others were formed by its decomposition: and I am strongly inclined to think that the same will be found to be the case in every situation where lead occurs.

To this conclusion I have been led by the following considerations.

I. Galena, or sulphuret of lead, is by far the most abundant, and generally diffused form, under which this metal is found; indeed, I may say it is incomparably more abundant than all the other lead-spars taken together.

II. I have not been able to ascertain that any one of the various lead-spars has been found where galena was not either immediately present, or in the vicinity of such situations, or had been wrought out in that quarter at some former period.

III. The appearance of the galena itself, in many situations, strongly evinces the reality of the change I have alluded to; for it may be seen in every gradation of decay, from its being merely covered with a dusky coating in place of its usual metallic lustre, to that state in which the greatest part of it is reduced to a black, or a dark-blue or grey powder.

In such situations, the cellular, or worm-eaten ore, frequently shews itself, owing to this very process going on: and still more frequently, such masses of decayed galena, and the contiguous veinstones, are studded over with crys-

tals of the various lead-spars; but most frequently, and abundantly, with crystals of the carbonate. Indeed, specimens sometimes occur with nearly all the different spars, distinctly marked in close approximation. I have in my own possession a specimen 2¼ inches square, and 2 inches deep, which has in perfection every variety found here, except the sulphate of lead.

IV. The various lead-spars occur most abundantly, and in greatest perfection, in those very situations where we would naturally expect to find them, on the supposition of their being formed from the decomposition of the galena; namely, in those veins which are open, and full of druses, and especially where the galena lies in detached masses, surrounded either entirely, or in part, by such vein-stuff as is readily permeable to water and air; agents, of course, quite essential to the production of the change in question.

V. In situations where it has been necessary to cut out solid rock in the vicinity of galena, the walls of a cavity so formed have been found, in a few years after, to be studded over in various places with minute crystals of carbonate of lead: also, the solid stones, which are sometimes left impacted on various parts, on being brought to day, some years after, are found to be covered with the same incrustations, conveyed there, no doubt, by the agency of water. To the same point, I may mention, that the vein-stuff, which it is necessary to bring to bank, and which, when brought up, has no appearance of being any thing but stones and rubbish, is, after being exposed for a few years, found to be covered with an incrustation of minute crystals of carbonate and phosphate of lead, which had not been observed when first brought to bank, owing to the very comminuted state in which it then existed.

VI. Many years ago, Mr John Taylor, an intelligent overseer at Wanlockhead (about a mile from this), observing a drop of water, which was forming an incrustation on the sides of the vein, placed a phial under the drop, to ascertain if any crystals would be formed, by what dropt into the phial. The experiment succeeded so far, that he had an incrustation of minute crystals formed on the bottom and lower part of the inside of the phial, which he considered as carbonate of lead. I have seen a piece of this phial (for it was broken); about two inches of the under part remain, and is covered with a coating of minute splendent crystals. I must, however, remark, that no particular analysis of these has been made, so far, at least, as is consistent with my present knowledge. The crystals are too minute to allow us to ascertain, even with a magnifier, their exact form; but from their very splendent lustre, and appearance in general, I have not the smallest doubt of their being the carbonate.

VII. I would refer those who may still feel sceptical, candidly to examine the appearances presented by the mines in this neighbourhood, when I think there is no doubt that they will be fully convinced of the facts I state being sufficient to warrant the conclusions I have drawn. I propose to send a few specimens to Professor Jameson, which, being deposited in the Museum, may afford those who cannot visit the Mines an opportunity of forming a more correct opinion on this point, than can be done without an examination of the whole *in situ*.

It is no difficult matter to imagine how this change may be brought about. We know how readily sulphur combines with oxygen, to form sulphuric acid, as is evinced in the formation of sulphate of iron from iron-pyrites. The lead being oxidised by the oxygen, arising from the decomposition of

water, or of air, or both; the oxide of lead will combine with the sulphuric acid, to form sulphate of lead; carbonic acid (which is constantly present in water) may combine with another portion of oxide of lead, and will form the carbonate; this last will be pure, dark, of various shades of black, according to the quantity of decomposed galena present. If oxides of iron or copper be present, they will communicate to the crystals as they form, various shades, according to their quantity. What are called the new minerals, namely, combinations of carbonate and sulphate of lead, in various proportions, can be easily conceived to occur from being simultaneously formed, and combining as compound crystals. As to the phosphates, I presume the acid must be derived from the surface; and what countenances this opinion is, that the best phosphates have been found either not far from the surface, or in veins which seem to have a pretty free communication with the surface, and to have a plentiful supply of water. I am aware that there are considerable quantities of apparently solid galena, which, on being broken, are found to contain masses of lead-spars, of various sizes and forms, interspersed through them, and which would seem as if necessarily formed contemporaneously with the consolidation of the galena. This seemed to me, for some time, to have been in reality the case; and, therefore, that an exception must be made to the general truth of the theory I am endeavouring to advocate. But *now*, I conceive that this difficulty may be easily surmounted, by supposing the galena to have been consolidated, with a number of these small cavities in it. Galena in higher situations, being transformed in the manner which I have supposed, the water which permeates the strata may take up the carbonate of lead, and, in its course through the neighbouring parts of the same, or other strata, may deposit it, in a crystalline form, in situations, where, by rest

and other favourable circumstances, an opportunity is offered for the formation of crystals; or it may be deposited in a massive form. I may observe farther, that galena, abounding with such patches of the other lead-spars, is, in general, what is brought from a considerable depth, thus affording full opportunity for the operations I have pointed out going forward.

I am aware of the objections which may be brought against my hypothesis, in consequence of the insolubility of the lead-spars, in the menstruum stated to be the principal agent in these operations; but when it is recollected that silica (a substance of equal insolubility) frequently occurs in many natural craters, the objection, I apprehend, will not be considered a very valid one.

I have stated my ideas to most of those engaged in the works here, and I now feel myself warranted in saying, that their opinions (and these I consider valuable) coincide generally with that I have myself formed, and which I have now communicated to you.

I have frequently conversed on the subject with Professor Irving, whose acquirements in science, and residence here for twenty years as agent for one of the companies, have afforded him ample opportunity of forming correct ideas; and these, I am happy to say, agree with my own.

I hope the few observations I thus offer, may induce others, more fitted for the task, to direct their attention more particularly to this subject than has hitherto been done; and any further observations I may have an opportunity of making shall be most readily communicated to you.

I remain, &c.

James Braid.

Leadhills, *March* 4. 1823.

XLII.—*Description of a New Species of Larus.*

By Thomas Stewart Traill, M.D. F.R.S.E. &c.

(*Read 8th February 1823.*)

Larus Scoresbii, *Scoresby's Gull.*

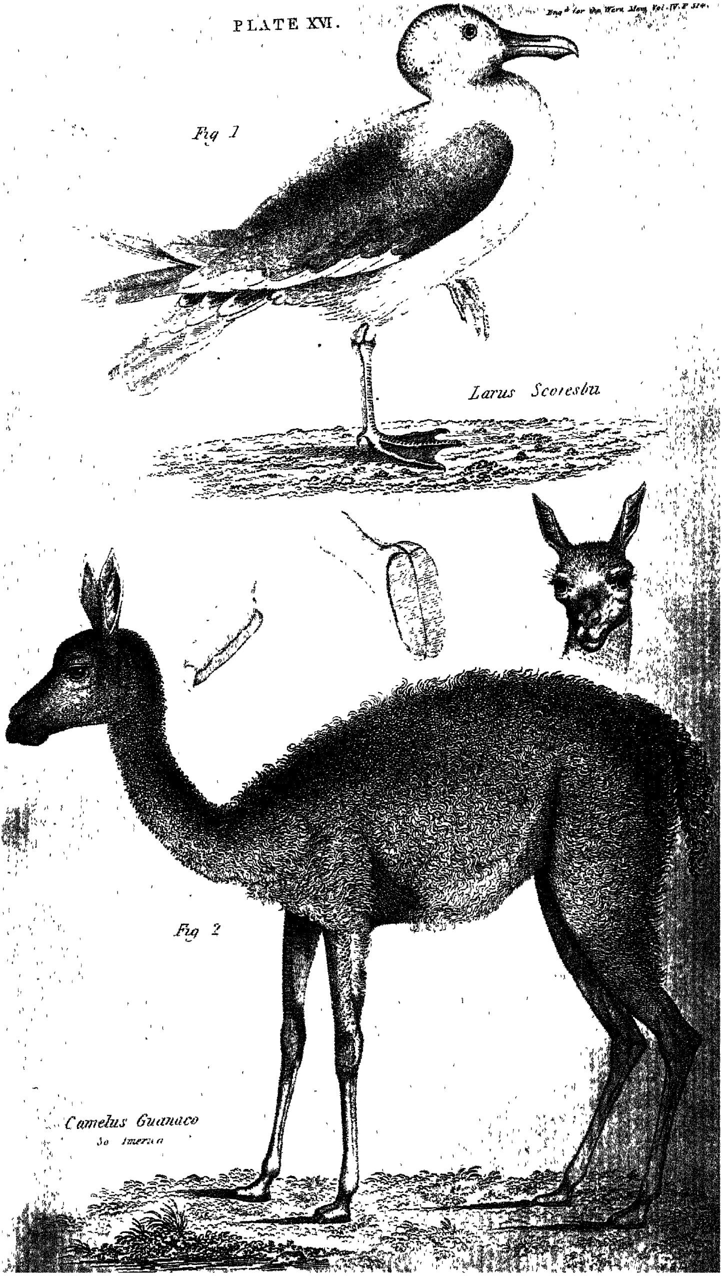
[illegible] rostro forti, sanguineo [illegible] coloris; capite, [illegible] partibusque imis dilute canescentibus; alis nigrescentibus; cauda æquali, alba.

Gull with bill strong, and of a vermilion-red; legs and feet of the same colour; head, neck, and lower parts pale ash-grey; wings blackish; tail even, white.

THIS bird, which is now in the Museum of the Liverpool Royal Institution, appears to be a non-descript species, of which the characters are extremely well marked, while it has no indication of being a gull in imperfect plumage. It is said to frequent the frozen regions of the Southern Ocean; and I have named it in honour of the celebrated navigator of the Icy Seas.

PLATE XVI.

Eng[d] for the Wern. Mem. Vol. IV. P. 514.



Description. Its extreme length (Plate XVI. fig. 1.), from the tip of the bill to the end of the tail, 19 inches; its breadth could not be well ascertained in the state in which it came into my hands; but could not be less than about 3 feet. The bill, thighs, legs, and feet, are of a fine vermilion-red. The bill is very strong, dilated near the extremity, and suddenly bends at the tip, like that of several of our larger gulls. It measures 1.5 inch in length, and equals 0.6 inch across its broadest part. The nostrils are perforate, of a pyriform shape, with the blunt end toward the point of the bill. They lie in two deep furrows or *sulci*, which run from them to the capistrum, along the sides of the upper mandible. There is no appearance of a cere; the feathers of the forehead descending into the furrows above described.

The whole head, neck, breast, and belly, the upper and under coverts of the tail, pass from ash-grey to a greyish-white, which is palest on the under parts. The nape of the neck is of a more decided ash-grey colour. The scapulars pass into blackish-brown, and a few of the longer feathers are tipt with greyish-white. The feathers of the upper part of the back resemble in hue the scapulars; but this colour changes gradually to an ash-grey, as it descends toward the upper tail-coverts.

The wing-coverts are brownish-black. The primaries have a still deeper shade of the same colour. Their shafts are black above, and whitish below. The first quill is spotless, but the other five primaries are each tipt with a white spot, which becomes larger as they recede from the edge of the wing. The extremities of all the secondaries are pure white, forming a broad band along the middle of the wing, when it is closed. The under coverts of the wings are deep ash-grey.

The tail consists of twelve pure white feathers of equal length; the coverts are long, especially the under ones,

which reach to within half an inch of the extremity of the tail.

The thighs are naked a little above the knee; their colour, as well as that of the legs and feet, is a deep vermilion-red. The claws are of a brownish-horn colour.

Nothing is known of the habits of this bird; the skin of which was brought by one of our ships, that was sent to New South Shetland, for the purpose of prosecuting the seal-fishery. By the same vessel also were received the following specimens:

2. Larus Catarractes. Rather smaller than the Skua of Foula.
3. Aptenodytes Magellanica. } LATHAM.
4. Aptenodytes Papuensis. }
5. Sturnus Magellanicus.
6. Charadrius. Probably a non-descript species.
7. Loxia?
8. Fringilla. Probably a species hitherto undescribed.

LIVERPOOL, }
November 1822. }

XLIII.—*Remarks on the Specific Characters of Birds.*

By Mr W. MACGILLIVRAY.

(*Read 22d March* 1823.)

IN laying the following observations before the Society, I trust that, however fanciful they may at first sight appear, they will at least receive an impartial consideration; and if rejected as inadequate to the object in view, they may yet not be entirely without their use, as they may tend to excite a greater degree of attention to an interesting and important subject, and prove the means of ultimately supplying a desideratum in ornithology, which cannot but have been deeply felt by all who have seriously engaged in that department of natural history.

The views which I have taken of the subject, although directed toward circumstances of general application, have no reference to the various degrees of generic association. I have no alterations at present to propose in the divisions

of systematic ornithology, nor is it my intention to find fault with the grouping of specific forms as made by different naturalists, according to the limited or extended opportunities or knowledge, or faculties of perception or discrimination, which they may have possessed: my object is to rectify a series of misapprehensions,—a want of method, and still more of precision,—a laxity of characterisation, productive of a useless, tiresome, and unphilosophical diffuseness of expression, on the one hand,—and, on the other, of an awkward and unsuccessful wresting of marks, not in themselves sufficiently important, to answer particular purposes, which, in many instances, may, with as much probability of truth, be construed into a desire for celebrity, as into a regard for the advancement of science.

The want of sufficiently precise and distinctive characters to designate the various species of birds, cannot have passed unobserved by any who have been in the habit of consulting systematic arrangements. From the concise characters of the great LINNÆUS, to the exuberant and seemingly comprehensive ones of the justly celebrated TEMMINCK, we find, among considerable diversity of method, and variety of manner, few that can bear the test of critical examination.

Of the different modes of characterising the specific forms of the feathered tribes, I shall mention a few, and those the most generally adopted, stating, at the same time, their peculiar deficiencies; but previous to this, it becomes necessary to propose a short series of aphorisms, containing some of the principal points upon which the ultimate object of all classification is founded. These aphorisms will admit of little discussion: they are generally acknowledged truths, and which, it is conceived, must arise spontaneously, as it were, in the mind of any one who, in thinking seriously

upon the subject, has endeavoured to divest himself of all prepossession. It is only further to be premised, that the Specific characters alone, not the generic, or ordinal, or classic ones, are those which it is intended to elucidate.

1. The characterisation of specific forms is the principal object of systematic arrangement.

2. In a natural-history point of view, the characters are to be taken, in zoology, from obvious, consequently from external parts.

3. They must be taken from permanent and essential organs, or circumstances.

4. From whatever circumstances the characters of the more general or comprehensive divisions of a system or arrangement, as being in some measure arbitrary, may be taken; those by which specific forms are to be designated, must be from circumstances positive, certain, fixed, determinate, not liable to lead to misinterpretation or ambiguity.

5. Specific characters, in a logical point of view, should be concise, positively expressed (the negative form giving rise to misapprehension, and not presenting an image of the object), direct, and perspicuous; essentially or intrinsically, they should be perfectly distinctive, whether in their simple and individual capacity, or by comparison with others.

This much being admitted,—and the exclusion of negative characters, which is a point that may be allowed or not, is perhaps the only objectionable part,—I proceed, as proposed, to mention a few of the more generally adopted modes of characterising the Species of birds.

The first and most generally, in fact universally, used character, is that derived from Colour, chiefly from the colour of the plumage. To characterise the different spe-

cies of a genus, it has been thought sufficient, where the colour was laid out in mass, a principal tint pervading the greater part of the plumage, to epitomise the whole by a general expression, adding to this one or more of the colours by which the subordinate parts were marked; or, where the colours were distributed in patches, to select the most striking, or seemingly characteristic. For example:

Trochilus moschitus; T. viridescens, vertice purpureo aurato, gutture auroreo-rutilo. BLUM.
Parus major; P. capite nigro, temporibus albis, nucha lutea. BLUM.

And various other modifications of the same principle have been used, according to the particular circumstances of the case.

The feathers, however, are not the only parts whose colours have been thought of sufficient importance to furnish specific characters: the bill, the eyes, the legs, the claws, the wattles, and other appendages, have also afforded marks of this kind. For example:

Falco communis; F. rostro cœrulescente, cera iridibus pedibusque luteis. LATH.
Vultur pondicerianus; V. capite colloque, incarnatis, lateribus colli caruncula, rubra. LATH.

The colour of the iris, in particular, has been assumed as a character to which much importance has been attributed, and which BRISSON, MONTAGU, TEMMINCK, and others, seem to have regarded as an infallible criterion. Thus, for example, the last-mentioned ornithologist, in giving what he considers as the distinctive characters of the raven and carrion-crow, describes the iris of the first as being "a

deux cercles, gris blanc et cendré brun," and that of the other as "couleur de noisette."

Now, in forming an estimate of the sufficiency of such characters as these for fulfilling the objects intended, namely, the distinction of specific forms, the questions which necessarily occur are,—Do they possess the essential requisites? Are they taken from obvious parts? From positive, certain, fixed, determinate organs or circumstances? Are they liable to misinterpretation, or are they ambiguous? And, lastly, are they essentially distinctive?

It may be observed, in the first place, and before proceeding to the solution of these questions, that characters taken, not from forms, but from qualities, and those, too, not essential, as is the case with colour, cannot well be said to be peculiarly fitted for distinguishing specific *forms*. But as this may have something of sophistry in it, inasmuch as specific form being an abstract idea, it may as well be rendered tangible to the comprehension, through the medium of qualities as of forms,—or, at the best, may not be an obvious objection, the idea simply of species may be substituted for that of specific forms.

With regard to obviousness, no one surely will deny that these characters are taken from obvious *parts;* and the quality of those obvious parts on which they depend is not merely obvious, but that which, next to the size and general contour of a bird, impresses itself the most forcibly upon the mind, and, on taking a very hasty glance, it is almost the only property retained by the perceptive faculty. This, however, of itself will not constitute an incontrovertible qualification, for, in most respects, it is on a similar footing with Size, which, in all departments of physiography, has been not without reason rejected as a specific character.

From positive, certain, fixed, determinate organs, they cannot, in the true meaning of the words, be said to be taken, inasmuch as it is merely a quality or circumstance of such organs that they express. But let this pass; and let the question be, Is the circumstance from which they are taken possessed of those qualifications? It is not necessary, as I shall afterwards shew, that the quality or circumstance should be common to all the varieties of a species; but is colour certain, fixed, and determinate in the male birds of a species, from which the distinctive characters are usually taken? That it is not, every one at all acquainted with even a very limited number of the species of birds, knows and laments. The colours of the same species vary in different stages of life (not reckoning those which precede maturity), in different states of plumage, at different seasons, and in different climates. This assertion cannot be disputed; it is acknowledged by all: nevertheless, that nothing which I advance as fact may seem to be deficient in authenticity, I shall adduce examples.

Colour differing in the same species, beyond maturity, is seen in the *Falco Albicilla*, which, from a light-brown, becomes much paler, the head tinged with cinereous, and the tail at length altogether white. *Falco Buteo*, varies from a deep chocolate-brown, through paler shades of the same colour, to white.

In different states of plumage, and at different seasons, almost all birds vary in some degree: witness in particular the Ptarmigan, the *Uria Grylle*, *Charadrius pluvialis*, *Tringa variabilis*, TEMM.

Climate operates like season: birds, in general, become whiter in arctic countries; as, *Strix Bubo*, *Corvus Corax*.

That colours are liable to misinterpretation, surely no one will think of denying. From the very nature of colours,

from the endless combinations which they undergo, it becomes, in many cases, impossible to express, and even difficult to perceive, their true relations. When we see such vague and indeterminate expressions, as, *cinereus*, *cinerascens*, *albus*, *albicans*, *niger*, *nigricans*, *fuscus*, *fusco-nigricans*, *viridisv*, *irescens*, *ruber*, *rufus*, *rubicundus*, *rubescens*, *rosaceus*, *aurcus*, *æneus*, *luteus*, and find that each of these terms, as applied to different species of birds, includes a great variety of tints, differing widely from each other, we cannot but perceive that no precise ideas have been attached to them. A general objection, therefore, to the use of colour as affording specific distinctions, is, that however people may agree with regard to the principal colours, such as white, black, brown, blue, scarcely two individuals will be found who have precisely the same ideas with regard to many or most of the almost innumerable tints with which the hand of Nature has pencilled the plumage of the aërial wanderers. The ideas even of the best writers on this subject have been, and still continue to be, very confused, and their descriptions of colours are often at utter variance, not only with those of others, but even with their own depictions. This, however, may be thought to form no true objection: were the statement correct, as it is believed to be, it might not, after all, form an insuperable bar to the use of such characters; for objects, as apparently beyond the reach of investigation, have been illustrated, and even specified, with great precision. And although a philosophical arrangement of colours be still a desideratum in science, it is a desideratum which may be supplied, when persons qualified for the undertaking shall direct their attention to it.

The colour of the feathers, however, as has been shewn, and as is pretty generally felt, being deficient as a character

in the essential qualities enumerated, cannot with any propriety be used, should a method possessed of those qualities be pointed out. It is the difficulty of finding such a method, more than the conviction that the present one is the most eligible, that would appear to induce ornithological writers to adhere to this method.

Enough, I imagine, has been said on this subject: it requires little ingenuity to shew the futility of what every body acknowledges to be futile, however much it may require to persuade men to abandon a practice established by authority, and sanctioned by habit. The observations made would be of little importance, were they not intended as introductory to a method of characterising the species of birds, which shall presently be announced. With this object in view, a few more remarks may not be altogether improper.

And first, it is necessary to advert to the colour of the iris (some have even gone so far as to notify the colours of the down and even of the skin; all which is very becoming in the way of description, but can have little to do with specific distinction), which may be thought to merit particular attention. The colour of the iris forming a character, belonging to a very delicate part, which is the most easily altered by the action of the air, and by other causes, after death, is seldom in a condition to be examined by the time that a specimen comes to the hands of a naturalist. From my own experience, I can say little more on this subject than merely, that, being precisely in the same predicament with the colour of the feathers, it must necessarily share the same fate. This conclusion is corroborated by the experience of Mr John Wilson, who will be found to possess a stock of practical information in ornithology, which, in a matter of fact, entitles him to much more credit

than the best systematist, or closest naturalist. The result of Mr WILSON's observations is, that, in general, in his opinion, no great reliance can be placed upon the colour of the iris, for it varies not a little in a great proportion of the birds which have come through his hands. He adduces as examples the *Falco Æsalon* and *F. Buteo*, which, even after being full grown, exhibit in their iris all the intermediate tints between a deep brown and bright yellow. The iris of the *Sula alba*, when young, is black, in the second year brownish or dusky, in the third whitish or light grey, and the white becomes purer as age advances. The iris of the Sea-Eagle, or young of the *Albicilla*, lightens from deep brown, or blackish, as the bird advances toward maturity, and continues to become paler and paler long after this period. And the same also he has observed of other birds.

The colour of the beak, the legs, the claws, and other parts, may be somewhat more permanent; but the variety exhibited here is of by far too little extent to afford specific characters: the almost universal colours are, dusky, horn-colour, and blackish, with a considerable proportion of yellow, and some greenish, and a few other tints; so that the colours of these parts can only at the utmost afford a very casual distinction.

Finally, Has not an adherence to colour been productive of disjunctions which are every day becoming more apparent? And have not individual species been split into two, three, even four, by this uncertain and misapplied distinction? The *Colymbus glacialis* and *Immer*, the *Alca Torda* and *Pica*, the *Anas Clangula* and *Glaucion*, the *Tringa cinclus* and *alpina*, the *Larus tridactylus* and *Rissa*, and a numerous host of other binary schisms, support in so far the truth just stated; and for ternary and quaternary ones, we have only to consult the Gmelinian edition of the "Systema Naturæ," and even the more precise "Index Orni-

thologicus" of LATHAM. That this also may not be thought deficient in proof, I shall adduce an example:

GMELIN.	LATHAM.
Falco cyaneus.	Falco cyaneus.
—— bohemicus.	—— europhigistus.
—— albicans.	—— griseus.
—— pygargus.	—— pygargus.
—— griseus.	—— rubiginosus.
—— montanus.	—— ranivorus.
—— hudsonius.	
—— Buffonii.	

And not only has this adherence to colour produced divisions in identical species, but it has even induced systematic authors to place at wide distances from each other animals of precisely the same specific form. Nothing can more display our want of real knowledge in ornithology than this: it is surely little calculated to make us proud of our acquirements, when, on determining two birds to be of the same species, we turn to our systematic arrangements, and find these two birds not placed the one after the other, as their natural identity would lead us to expect them, but with the intervention of half a dozen or more species. The *Falco Albicilla* and *ossifragus* are of this description, and many others, which it is unnecessary and would be tedious to enumerate. Characters, therefore, derived from colour, are not sufficiently distinctive.

The comparative length of the tail, of the wings, and still more of the tarsus and middle toe, are also characters in use; but these, at least the two first, cannot be of general application, being only capable of being used occasionally as a specific character, and more frequently as a divisional one. The latter of these modes I cannot imagine to be of the most trifling utility: it affords no positive cha-

racter, being founded merely upon a comparison of parts, in themselves of little interest, in as far as regards mere length; nor does it appear in what respect advantage is to be gained from knowing that the middle toe of one duck is a quarter of an inch longer than its tarsus, or a tenth shorter than that of another duck. No systematic ornithologist has as yet thought of founding his generic characters upon the length alone of the beak; and, although the case be somewhat different with regard to the feet, they seem to be as little capable of affording distinctive marks for the species.

The *form* of the wings, as well as of the tail, has been used as a character; and here all the requisite qualifications are present: but in these parts there is by no means a sufficient variety of form to admit of any thing like general application; and, in very many cases, almost all the species of a genus have precisely the same form of wings and of tail. Witness the genera, Gallus, Phasianus, Sterna, Larus, Motacilla, Phæton, Turdus, Oriolus, &c. In fact, from this uniformity of the wing in birds of the same genus, TEMMINCK has derived one of his numerous generic characters.

The presence of certain appendages (or ornaments, as we usually denominate them, forgetting that Nature produces nothing merely ornamental), such as tufts of feathers on the head or neck, of various forms,—fleshy, cartilaginous or bony excrescences on the same parts,—spurs on the legs,—and spines at the flexures of the wings, has also been used to characterise specific forms, as in the *Pavo cristatus*, the different species of the genus *Crax*, *Phasianus cornutus*, *Ph. nycthemerus*, *Anas gambensis*, *Palamedea cornuta*, &c. All these are only occasionally present, however, with the exception of the spur on the flexure of the wing which is nearly universal, and consequently can only furnish an oc-

casional, and in most instances merely an auxiliary character. These parts, however, being in general permanent and definite, afford, when present, very good distinctive marks. With regard to the spur on the wing, so remarkable in the *Anas gambensis*, *Parra jacana*, *Charadrius spinosus*, *Palamedea cornuta*, and a few others, I may here observe, though this has no immediate connection with the subject, that, so far from being confined to a few species, as has hitherto been imagined, it is present in almost every bird, though under a very slight degree of development in the greater number. Of this fact, any one may very easily satisfy himself. It is particularly evident, or rather palpable, in the Heron tribe, among the waders in general, and in the Gallinaceæ: nor do I remember a genus at present destitute of it, excepting those birds whose wings are so small as to be of no use for flying, such as the Aptenodytes, Casuarius, and one or two more. When it has acquired so great a degree of elongation as to protrude beyond the feathers, it may be used as a character; but as this is very rarely the case, it cannot be of much importance as affording a character of whatever kind.

The only universal character, namely, colour, therefore, being found deficient in many essential respects, and the others being only capable of occasional use; I would propose, as being of general application, founded upon permanent and essential organs, and sufficiently diversified to comprehend a much greater number of specific forms than any others, characters derived from the situation, form, structure, and position, of the feathers.

The experienced botanist would smile at the idea of characterising the species of plants by the colours of their roots, or stems, or leaves or petals, in preference to the form and position of those parts. Is it not equally unsatisfactory to describe the colour of a feather, of an adventitious circum-

stance liable to alteration and misapprehension, in preference to the form and structure of that feather, qualities essential to its existence, permanent and positive, and not liable to misinterpretation?

In this point of view, the matter does not seem to admit of a doubt; and it cannot but appear singular, that if the characters afforded by the forms of the feathers be in reality such as they have been here represented, they should have been overlooked. They have not, however, been absolutely overlooked: as I have already mentioned, they have occasionally served to furnish an auxiliary character when they obtruded themselves, as it were, upon the view by some remarkable peculiarity,—chiefly, however, elongation, and not form or structure. Ornithologists would seem to have looked upon the plumage as one individual mass or aggregate; and hence as capable of affording no other characters than those of dulness or glossiness of surface, a silky or harsh feel, and such like. But the moment it is considered as composed of very numerous parts, arranged into groups assuming a vast variety of characters, it cannot fail to excite attention, and direct the current of thought into a new channel.

By the opportunities afforded me in the course of my duty in the Museum, of observing the varieties of plumage in many hundreds of species, I have benefitted so far as to see, that a better mode of characterising species than any hitherto used, could, with some attention, be brought into a condition fit for application. Nor is it a crude idea that I have presumed to force upon the notice of the Society: it was first formed in the spring of last year, and since then I have fully convinced myself of its practicability.

Before applying the character, it would be necessary to form a sufficient nomenclature or terminology. This would not be an extremely difficult task; and the number of new

terms to be invented would not be very considerable, as the terminology of botany would afford a great proportion in as far as regards form,—and that of comparative anatomy, or even of ornithology itself, in as far as concerns situation. In the deficiency of a systematic terminology, my illustrations of the method proposed can only be limited: but if, by selecting a few genera from among the various tribes of birds, I shall be able to shew, that it not only applies with great effect to them, but also affords characters far superior to those previously used, it may be in a manner taken for granted, or at least allowed as probable, that the method is capable of being extended to the whole series. The terms which I shall use may not be the most judicious, in a logical point of view, as the object must be to present a clear picture, and it is therefore necessary to use familiar, and, at the same time, perspicuous illustrations.

The genera which have been selected for the purpose of exhibiting the application of the method, are the following: Gallus, Paradisea, Corvus, Ardea, and Anas; and of these a few only of the species will be taken, as the whole would occupy too much time. Let it, however, be understood, that particular attention is not paid to the regular construction of the characters, according to the rules prescribed by methodical writers, or arising necessarily from the nature of things, it not being intended to exhibit a specimen of what characters ought to be with regard to verbal or logical precision, but with regard to obvious and determined distinctions.

GALLUS.

GALLUS *Sonneratii*, Jungle Cock.

G. plumis collaribus, alarum tectricibus, uropygii lateralibus, rachi complanata membranacea, nitentibus, pectoralibus dorsalibusque sub-ellipticis obtusis.

Feathers of the neck and rump and wing-coverts having a flattened cartilaginous shaft, and glossed; those of the breast and back sub-elliptical obtuse.

GALLUS *furcatus*, Fork-tailed Cock.

G. plumis collaribus rotundatis, bullosis, metallizatis, pectoralibus elongatis, dorsalibus attenuatis obtusis laxe marginatis.

Neck-feathers rounded, bullate, with metallic lustre, breast-feathers elongated, dorsal attenuated obtuse, with a loose margin.

GALLUS *lanatus*, Silk Cock.

Plumis universis, præsertim collaribus laxissimis, barbis apice simplicibus, setosis.

All the feathers, especially those of the neck, extremely loose; the barbs simple at the tip, and bristly.

PARADISEA.

PARADISEA *apoda*, Common Bird of Paradise.

P. plumis hypochondriis laxissimis arcuatis, corpore longioribus acutis, rectricibus duabus intermediis, longissimis setosiusculis, barbulis obsoletis.

Feathers of the hypochondria extremely loose, arcuate, longer than the body, acute; the two middle tail-feathers very long, bristly, the barbs obsolete (or rudimentary).

PARADISEA *regia*, King Bird of Paradise.

P. plumis hypochondriis densiusculis oblongis, quadratim obtusis, apice metallizatis; dorsalibus laxiusculis, barbis setosis; pennis caudæ duabus setosis longissimis, apice extrorsum barbatis, gyratis.

Feathers of the hypochondria somewhat dense, oblong, squared at the ends, with metallic lustre; dorsal fea-

thers somewhat loose, their barbs bristly; two very long bristly feathers in the tail, barbed externally at the tip, and gyrate.

PARADISEA *sexsetacea*, Gold-breasted Paradise-Bird.

P. plumis hypochondriis longitudine alarum laxis apice rotundatis, rigidis, metallizatis; capitis utrinque tribus setosis apice barbatis.

Feathers of the hypochondria of the same length as the wings, loose, rounded at the tip, stiff, with metallic lustre; three bristly feathers on each side of the head, barbed at the tip.

PARADISEA *nigricans*.

P. plumis hypochondriis oblique tortis, quatuor posterioribus in seta desinentibus simplici, abrupte curvata, pectoralibus elongatis, lateralibus oblique curvatis, latissimis, margine metallizatis.

Feathers of the hypochondria obliquely twisted, the four posterior terminating in a simple bristle, which is abruptly bent; side-feathers obliquely curved, very broad, with metallic lustre on the margin.

CORVUS.

The genus Corvus may be taken next for illustration of the method proposed. And here it is necessary to remark, that where the forms and other qualities of feathers are not very prominently marked, or rather not obviously singular, it is impossible, in the deficiency of terms, to render those forms and qualities perfectly intelligible by ordinary language. In the genus Corvus, therefore, where some difficulty exists, instead of inventing terms to express the qualities of the plumage, I shall merely point out such of those qualities as are necessary for specific distinction, in a some-

what diffuse manner, in order to be the better understood.

In commencing the consideration of this genus, an interesting subject of discussion presents itself in the perfect similarity, with regard to colour, of two of the more generally diffused species, the Raven and Carrion Crow, species nearly allied in habit, and, according to our present modes, distinguishable only or chiefly by size, the first being about 2 feet long, the other $1\frac{1}{2}$. The characters, as given by TEMMINCK are,

C. Corax,—Of a beautiful glossy black, with purple reflections, on the upper part of the body, tail much rounded and black; beak strong, black, as well as the feet; iris with two circles, light grey and brownish ash. Length 2 feet.

C. Corone,—Much smaller, of a deep black, with violet reflections, the tail slightly rounded; beak and feet black; iris hazel. Length $1\frac{1}{2}$ feet.

And such, or of similar import, are the usual characters given by authors. With regard to the differences, "beautiful glossy black, with purple reflections," and "deep black, with violet reflections," they are neither obvious nor distinctive. The fact is, no difference of the kind exists. In both species, the whole plumage is glossy or shining, especially the back, of a deep black, tinged with purple on the upper parts, and having a few green tints interspersed, and tinged with green, and having a few purple tints beneath. Colour, therefore, is out of the question.

The more obvious distinctions are the following: In *C. Corax*, the tail is longish, that is more than one-half the length of the body, and much rounded, the feathers slightly bent upwards: in *C. Corone*, the tail is moderate, that is, about half the length of the body, very slightly round-

ed, the feathers slightly deflected. These characters, however, are not distinctive, for another species, the *Cornix*, agrees precisely with the *Corone*, in this respect. Better characters can be obtained from the plumage; in fact, the only characters that can be of sufficient weight, for the colours of the iris, are neither such as TEMMINCK has described them, nor are they, as I have already shewn, to be much depended upon.

In the raven, the gular feathers are elongated, raised, compact, acuminate; in the crow, they are small, adpressed, with the barbs loose at the margins;—in the raven, again, the cervical feathers are long and tufted, having that soft and silky texture which produces an uniform glossy plumage, in which the individual feathers cannot be distinguished; in the crow, the same feathers are moderate, and have that particular texture, in which the plumage appears composed of small ragged points.

Here, then, the method which I propose, furnishes a sufficient character.

Between the *Corvus Corone* and *C. Cornix*, the differences in the structure of feathers are so small, though they do palpably exist, that, for want of terms, I cannot give any adequate idea of them. The most obvious differences exist in the gloss of the plumage, it being perfect in the first, and wanting in the other, and in the different form and structure of the gular and pectoral feathers.

In the *Monedula*, the gular feathers are small, lax, rounded, with the rachis downy, the vertical feathers are compactish and distinct, those of the neck blended, soft, and elongated.

The *Pica*, which is assuredly a true Corvus, is distinguished at once by the long cuneated tail, and the singular form of the gular feathers, in which the barbs are few and distant, and each feather terminated by a longish bristle,

covered at its base with a very fine down. The breast feathers are rounded, compact, and abruptly separated from the lax elongated feathers of the lower pectoral and abdominal regions.

The Jay, which is also a true Corvus, is also easily distinguished by the peculiar loose texture, and elongated form of the whole under surface and neck, as well as by the wing coverts, which are compact and stiff.

The next tribe to which I shall apply the character, is the great group of waders, distinguished by the name of Ardeæ.

The Common Heron might be characterised as follows: A. cinerea,—Plumis verticis elongatis, attenuatis, laxis; cervicis inferioribus laxissimis scapularibusque elongatis, apice producta, lineari, acuta.

The *Garzetta*,—Plumis verticis elongatis laxissimis, barbis simplicibus, cervicis inferioribus elongatis, laxissimis, scapularibus ad caudæ apicem protensis, tortis, barbis remotissimis simplicibus secundis.

A. Agami might be characterised by the curved and linear form of the lateral neck feathers, the peculiar texture of the pectoral and ventral feathers, &c.

In short, I have not been able to find any two herons of acknowledged and indubitable species, that did not present obvious differences in the plumage.

Of the genera proposed, there now only remains that in which the numerous family of ducks is included; and here it is, in general, easy to mark the differences.

A. atrata, for instance, is distinguished at once by the undulated form of the inner quills, from the white swan. *A. mollissima* may be taken as an example of the great variety of plumage exhibited in one and the same bird, being peculiarly easy to distinguish, on account of the remarkable grouping of the feathers. Those of the head are, in

general, very minute, linear, cut even at the tip: a large patch on the back of the neck, having the feathers terminated by a sort of flattened stiff brush; on the back, the feathers are very broad, and clipped, as it were, or cut even at the ends: the inner quills are weak, and curved outwards, so as to overlap some of the primaries.

In the *Tadorna*, there is a similar characteristic grouping of the feathers, affording five or six varieties of outline, and many more of texture, &c.

Between this and the King Duck, which belongs to the same division, the differences are obvious and great, independently of the protuberance at the base of the beak, or even of the inner quills, which are curved outwards, as in the Eider.

Anas Boschas, *Querqucdula*, *Penelope* and *Crecca*, are very distinct in plumage.

A. viduata, besides other obvious markings, has a singular appendage to the tip of the tail feathers, consisting of a short bristle, with an augmented and rounded termination.

From the specimen here produced, it will be seen, that the character proposed might apply to at least a great proportion of the species of birds. My opinion is, that it could be extended to the whole; but allowing only a partial application, even this would be a matter of importance; and, were the attention of ornithologists directed toward this point, there can be little doubt that discoveries would quickly be made, which would determine species and varieties with much greater precision than can be attained by attending to colour alone. I find, by an observation of Temminck, regarding a species of Falco, that Vieillot would seem to have attended, at least in some instances, to the differences exhibited in the forms of the feathers, and it is probable others may have done so too. As to making any claims of discovery, or imagining there

can be any great merit in observing what any person, who has the right use of his eyes, may see, is by no means my intention. I shall, on the contrary, be happy to find, when I have better opportunities of extending my reading, that others may have fostered the same ideas.

The specific characters, not only of birds, but of quadrupeds, fishes, reptiles, and other animals, is a subject, which, so far from being reduced to any sort of precision, exhibits a melancholy proof of the very limited progress, which, after all our labour and ingenuity, often misapplied, has been made in systematic arrangement. Until we become acquainted with the ultimate causes of things, until we have traced the whole machinery of the animated system, and can look around from the centre of life, as it were, upon all that complication of forms and actions which emanate from it, we can never attain perfection in system. At present our modes are exceedingly awkward and insufficient, and even lead not unfrequently to false conceptions. How to characterise a specific form, including the two primary divisions of sex, and the various modifications of those divisions, existing in the different relations of age, and of forms and qualities, induced or altered by changes in circumstanees, of climate, food, air, and other causes, is what we know as little, as to resolve the complicated phenomena of mind to their simple elements.

The specific characters of birds are commonly taken from adult males, in their spring plumage. A character of this kind, therefore, it is obvious, cannot apply in ten cases out of twelve, to the female, or other division of the specific form; and much less to the young birds of different years or months. As I have just observed, we can have no hope of becoming so intimately acquainted with the organization of animals, as to be able to fix upon characteristic differences, that would include the whole va-

rieties of a species. And knowing this, would it not be a more judicious plan to have a series of characters, peculiarly applicable to each variety of a species, in order to discriminate or designate that form with precision? In that case, the student,—and the most accomplished naturalist must never hope to be more than a student,—could determine a particular animal with precision, by comparing it with the series of specific characters. Nor is it by any means the case, that, even from such a series, a general character could be elicited, by taking the common points, for, according to our present knowledge, no such common points can be indicated. What, for example, is there in common in the plumage, much less colour, of the very old, middle aged, adult, third year, second year, first year, new-fledged and nestling, male and female Goshawk? Yet it is obvious, that, unless a specific character could comprehend something common to all these, it cannot be perfect. Such a character, if elicited, would prove to be an anatomical one; but how far distant is modern anatomy from the hope of this precision? Natural History does not found her distinctions upon investigations of internal structure: it is from the remoter, but to us more obvious, forms and qualities, which are manifested at the extremity, as it were, of the animated mass, where external causes exert their more immediate influence, and to guard against whose encroachments those very forms and qualities are adapted, being modified according to the peculiar circumstances of each specific mode of life, that we must take our characters,—from circumstances that are more immediately within our reach. Of those circumstances, surely colour cannot be the most important, nor shall I transgress farther upon your indulgence, by making any other remarks upon the defects attendant upon adherence to it. The forms and qualities of the feathers certainly do not afford characters

comprehensive of all the varieties produced by circumstances; that is, the feathers are not absolutely alike in all the stages of life; but surely no colourist can urge such an objection as this, for it would instantly recoil upon himself.

From what I have said, it will appear, that if the method which I propose were applied to the disputed species of birds, and should fail to determine whether they be really distinct or identical, this can form no objection to it. The form of the plumage, in fact, does vary in the same species with age; although apparently not by any means so much as colour. In the breast of the old Goshawk, for example, the feathers are broad; in that of the young bird they are narrow and elongated. In the first, the colour markings are transversal; in the other, they are longitudinal. In this respect, the methods may be even admitted to be in equilibrio. And here it may be remarked, that, between the colour and form or texture of feathers, there is a certain analogy, which, if strictly investigated, might lead to interesting results. A particular surface, or texture of feathers, seem, in general, to have a particular colour invariably attached to them; insomuch, that when a feather is described as to form, &c., we may yet be able to pronounce with certainty, without seeing it, what might be its colour.

But although form cannot identify the different varieties of a species, it would seem probable, that when two disputed birds agree perfectly in plumage, both being of the same genus, they must necessarily be both of one and the same species. This, for example, is the case with the *Alca Torda* and *Pica*, with the *Tringa alpina* and *Cinclus*, with the *Anas Bernicla* and *Erythropus*, and many others.

Whatever changes the same species undergoes as to colour, it often happens that the form of the feather remains unchanged; as in the Falco buteo, where, while the colour

varies from deep chocolate to nearly white, the feathers are the same in form and arrangement, whatever they may be in regard to surface.

Although I have not, by any means, exhausted the subject, while in truth I may, on the other hand, have expressed myself too diffusely, perhaps too vaguely, on some points, I cannot, in prudence, continue to impose upon you the irksome task of listening longer to a subject that has already been fully announced. It is a subject that would seem worthy of some attention; unfortunately, however, it requires minute, patient, strict investigation. But surely Nature cannot be too closely interrogated, nor can the labour of examining the plumage of birds be misapplied by the ornithologist. It is to Nature herself that I make my appeal, for the correctness of my ideas. The question is not, Are the views which I have taken such as may readily be entered into by others; but are they such as will be found, on examination, to lead to important results, while they are, at the same time, founded on Nature only? To determine this question, is a task that, in all probability, very few, or none, will readily trouble themselves with. I shall not, however, for this be the less induced to cultivate the subject; and if the result of my investigations prove of such a nature as I anticipate, I may have the satisfaction of again soliciting the attention of the Society, to a communication more worthy of their notice than the present.

EDINBURGH,
28th February 1823.

XLIV.—*Notes on the Geognosy of the Crif-Fell, Kirkbean, and the Needle's Eye, in Galloway.*

By Professor JAMESON.

(*Read* 16*th April* 1814.)

THE road from the town of Dumfries to New Abbey leads through a country composed of transition rocks, which are principally greywacke-slate, greywacke, and transition clay-slate. One of the most interesting points in this tract is Whinny Hill, which rises above the school-house of the parish of Traquair, where there is a junction of the syenite of the Crif-Fell group with the slate and other rocks of the transition series. The syenite in this hill is commonly of a grey, seldom of a red colour, and composed of grey felspar, green hornblende, grey quartz, and brown-coloured mica. The general structure is granular; some varieties, however, are slaty; while others, besides these structures, exhibit also variously formed contemporaneous portions of hornblende, of hornblende and felspar, of felspar and mica, and of felspar and quartz, varying in size from an inch to several feet in diameter, which give to

the rock a conglomerated aspect. In some of these contemporaneous masses the structure is simply granular, in others it is granular and slaty, and these latter in particular have much the appearance of broken masses; and phenomena of a similar kind, in other parts of Scotland, have been described as fragments contained in granite. These pseudo-fragments are sometimes intermixed with the syenite at their line of junction with it; in other instances, they gradually pass into the bounding rock; and occasionally veins or inequalities of the one shoot into the mass or body of the other, or there is a mutual interlacement of the pseudo-fragment and the syenite; and imbedded masses also occur, which are not intermixed with the bounding rock at their junction. These phenomena are of the same description as those we observe with the constituent parts of granite; for the concretions of felspar, quartz and mica, as is well known, are sometimes intermixed at their line of junction with each other, or there is no intermixture, or branches or veins from the different concretions mutually penetrate each other. Now, as it is universally admitted that the felspar, quartz and mica, in granite, have crystallised at the same time, it follows, that all mineral aggregates, such as the pseudo-fragments just mentioned, which exhibit similar phenomena, are to be viewed as instances of simultaneous or contemporaneous formation *.

There rests upon the coarse granular syenite, exhibiting the characters already mentioned, strata of syenite, having the fine granular, compact, and slaty structures, ranging from NE. to SW., and dipping to the SE. under an

* Even true fragments of various rocks, as of porphyry, syenite, &c. caused by agitations during the general crystallisation of the rock, may occur in granite.

angle of 60°. They vary in thickness from one foot to six or seven feet. The strata are generally straight; sometimes, however, they are waved in one part of their course, and straight in another: in some strata the slaty structure is throughout parallel with the seams of stratification; in others, it is more or less waved, and the waved and parallel structures sometimes occur together in the same stratum. Other varieties of arrangement are observable: thus, in the same stratum, one part will be a compact slaty syenite, in another, a compound of felspar and mica, forming a slaty micaceous rock, somewhat resembling gneiss. In other instances, a stratum, in part of its course, will appear as slaty syenite, while, in another, from the nearly complete exclusion of all the ingredients but hornblende, will have the character of hornblende-rock, hornblende-slate, or even greenstone: in other cases, portions of a stratum are formed entirely of felspar, and nearly in a compact state; or the whole stratum, as far as it can be examined, is of a greenish colour, and is compact felspar coloured with hornblende. These strata of compact and slaty syenite alternate with others of coarse granular grey syenite, and sometimes they contain imbedded contemporaneous portions and veins of coarse granular syenite and of felspar, and all of them are occasionally intersected with veins of quartz. These interesting rocks extend for several hundred feet from the line of junction with the great mass of syenite of this district, and gradually pass into the more common rocks, as greywacke slate.

The usual transition-rocks, with syenite, continue to the beautifully situated village of New Abbey. The hills above New Abbey are of granite and syenite, in both of which there are numerous imbedded crystals of sphene, and rarely crystals and grains of hyacinth. Both rocks are generally coarse granular, sometimes porphyritic, and the

prevailing colour is grey, red being of comparatively rare occurrence. In some cliffs we observed numerous pseudo-fragments of granite in granite, of syenite in syenite, of hornblende in syenite, of felspar in granite and syenite; and also contemporaneous veins of granite, of felspar and quartz, and of felspar alone.

From New Abbey to Kirkbean, the usual transition-slates are met with; but on approaching Carse, a watering-place on the shore, not far from Kirkbean, rocks of the coal-formation, more or less covered with alluvial matters, make their appearance. To describe all the geognostical phenomena in this quarter, would be inconsistent with the nature of these memoranda; but a few sentences will be sufficient to convey a very general view of the nature of the strata. Immediately under the soil, in many places, there is a bed of peat about a foot thick; below this a bed of clay, a foot and upwards in thickness; next a bed of gravel: in some places below the gravel there is a bed of clay, and the undermost layer of the alluvial series is a bed of gravel and rolled masses. The gravel and rolled masses are fragments of rocks of the district, and therefore are of slate, syenite, granite, sandstone, &c. The alluvial clays are sometimes impregnated with iron-pyrites, and the percolating waters issuing from them have chalybeate properties. None of the newer secondary formations occur in this part of the island; even those of a middle age are wanting, for the formation directly below that we have just described, is one of the oldest of the secondary class,—it is the principal coal formation. The strata of this formation, as it occurs here, are sandstone, mountain or first secondary limestone, abounding in petrified corals, particularly madrepores of great beauty, slate-clay, bituminous shale, and clay iron-stone. The positions of the strata are various, and afford a fine study for those interested in such geo-

gnostical relations. These strata, as we approach Crif-Fell, are succeeded by transition rocks, of which the best section I had an opportunity of examining, is in the burn of Kirkbean, in which the following arrangement is distinctly seen. In the burn immediately above the inn of Kirkbean, the rocks are of a greywacke, more or less inclined to sandstone; these are succeeded by a thick bed of porphyry, and this bed by an alternating series of beds and strata, of which the direction is NE. and SW., the dip to SE. These extend upwards for above 200 feet to their line of junction with the granite and syenite, of which the Crif-Fell is principally composed, and consist of slaty syenite and compact gneiss, which alternate with beds of coarse granular syenite. All above the line of junction just mentioned is granite and syenite. The syenite is sometimes slaty, and these slaty varieties resemble coarse granular gneiss. Contemporaneous veins of syenite, granite, and felspar, varying in magnitude from half an inch to two feet in width, are met with; and imbedded contemporaneous masses of various sizes and forms of syenite, and of greyish-black porphyry, coloured with hornblende, make their appearance in many places.

The rocks extending from Kirkbean to the neighbourhood of General DUNLOP's, as far as they could be seen, were transition. About a mile beyond General DUNLOP's, the syenite of Crif-Fell crosses the high road which leads to Colvend Kirk, and a by-path leads from this point down to the alluvial land of the Carse, and to a perforated rock named the *Needle's Eye*, concerning which some interesting details are given by Sir JAMES HALL, in the Transactions of the Royal Society of Edinburgh. The rock is composed of syenite and of slaty felspar, which are variously intermixed with each other. The syenite is red,

smaller granular than that of the Crif-Fell, and contains imbedded contemporaneous pseudo-fragments of slate. This slate, which is of a brownish-red colour, is a compound of compact felspar, and scales of brown-coloured mica: it is of the same nature as some of the slates at the junction on Whinny Hill already described, and is traversed by veins of red syenite. The slate is but a modification of the syenite,—a fact which shews that the slate, syenite, and veins, are of contemporaneous formation. A little to the west of the Needle's Eye, there are patches of a conglomerate, composed of fragments of the various rocks of the district; and to the westward of these, there is a display of strata, having the usual NE. and SW. direction, and a SE. dip under an angle of 60°. They are principally of rocks having a slaty structure; and of these the following are the chief varieties we had an opportunity of examining. 1. Slaty compact felspar, which is sometimes of a green colour, owing to disseminated earthy hornblende. 2. Slate, composed of compact felspar and brown-coloured mica. 3. Slate of compact felspar and hornblende, in short, a variety of greenstone-slate. These slaty rocks contain beds of syenite, granite, porphyry, and compact felspar. The syenite is of a red colour, like that of the Needle's Eye; and is disposed in beds of considerable thickness, which alternate with the slate: contemporaneous portions of it occur in the slate; and veins of it, sometimes several fathoms wide, traverse the slaty strata, which, notwithstanding their magnitude, may be viewed as of contemporaneous formation with the strata. The porphyry is of a green colour, with a felspar base, and contains scales of pinchbeck-brown mica. The compact felspar is red, has a perfect conchoidal and splintery fracture, and is not unlike some of the beautiful varieties of that rock found in Sweden. The slaty rocks and the syenite rocks are traversed by veins of

red compact felspar, and also by veins containing quartz, heavy-spar, copper-pyrites, and copper green.

The rocks of the Needle's Eye and the neighbourhood, afforded to the active and enterprising mind of Sir James Hall proofs in favour of the Huttonian theory of the Earth; to me they were interesting as illustrations of the doctrine of contemporaneous formation.

XLV.—*Observations on the Anatomy of the Beaver*, (Castor Fiber, *Linn.*), *considered as an Aquatic Animal.*

By R. Knox, Esq. M. D. M. W. S.
and Member of the Medico-Chirurgical Society.

(*Read* 19*th April* 1823.)

An opportunity having occurred to me lately of dissecting the Canadian Beaver, a few anatomical facts presented themselves, which apparently have hitherto escaped notice. Of these, one is in a remarkable manner connected with the habits of aquatic animals, and more especially with the power they possess of remaining for a considerable time under water. I shall now submit an account of these to the Society.

The specimens, two in number, were both females: their exact weight is unknown, but the cartilaginous condition of the bones demonstrate them to have been young animals. During a hasty examination of the integuments, I observed the supernumerary nail on one of the toes of the hind leg, a peculiarity known to exist in the Beaver of the Rhine and

Danube, and which, added to the general resemblance of their respective anatomical structures, would lead us to suppose that those of Europe and America belong not only to the same species, but even to the same variety. The specimens were so far mutilated, as to prevent any examination of the head and organs of sense contained therein. I observed, however, that the Beaver resembles many of the *Rodentia*, in having hairs growing on the inside of the mouth, near the angles; these perfectly resemble the hairs covering the integuments.

As both animals had died of inflammation of the intestines, producing, in one case, an extensive intus-susception, I found it impossible to make minute researches either into the structure of the internal tunic, or into the exact distribution of the bloodvessels. That which appeared to me most remarkable in the sanguiferous systems of the abdominal viscera, was the presence of an extensive sinus, or receptacle for the blood, situate close to and above the liver, at the point where the peritoneal coat is reflected from the abdominal surface of the diaphragm upon that organ. Into this horizontal sinus entered the *lower cava* and hepatic veins, and from it arose a single trunk conveying the blood into the right auricle of the heart; the diameter of which trunk certainly did not exceed that of the abdominal cava, immediately on its receiving the renal veins. The foramen ovale of the heart was closed, and the ductus arteriosus converted into a ligament. The Eustachian valve was very perfect; and another similar valve was found at the entrance of the *superior cava* into the right auricle of the heart.

The ductus communis choledocus and pancreatic duct entered the intestines at a distance of about 14½ inches from each other. The physiology of this part of the structure of animals is not at all understood. In general, how-

ever, it may be said, that, in the Rodentia, the passage of the bile and pancreatic fluid into the intestines is much apart. I consider it unnecessary to dwell on the minute anatomy of the intestinal canal or generative organs, as it would be difficult to add any thing to the descriptions of M. Cuvier, contained in the celebrated works of that distinguished anatomist. I could not perceive the least difference in the lungs from those of the class Rodentia.

The peculiarity in the structure of the venous system I have just described, is, no doubt, connected with the habits of the beaver as an aquatic animal. That it is exposed occasionally to long submersion, we may readily imagine, as well in escaping from its enemies, as passing under the ice in winter. In some animals whose habits are similar, we are assured that a similar venous sinus exists: it has been remarked in the seal, and in diving birds, as the duck; but I have observed that, in birds of this kind, the whole venous system is remarkable for the large caliber of the vessels; for their number, and for the frequent and extensive plexuses they form in almost every part of the body. The golden-eyed duck presents this appearance most remarkably.

It is extremely probable that this theory, drawn from anatomical facts, and supported by the authority of Blumenbach, would have been universally adopted long ago, but for the limited views of the strictly human anatomist: these led to some curious, but uninstructive experiments in France, which contributed to throw the subject into still greater confusion. The *fœtal* circulation of the mammalia was transferred by a false analogy to the full-grown Cetacea, and to other aquatic animals: it was supposed that these animals were amphibious, by reason of the peculiar distribution of vessels, and of structure, enabling the blood to pass from the right to the left side of the heart without

traversing the lungs. We now know that this false analogy gave rise to many errors, and to some singularly unproductive experiments.

Of the objections which may be offered to this opinion of the uses of the venous sinuses in aquatic animals, one may be urged, drawn from the apparent inadequacy of the means provided by nature, for the suspending of a function so essential to life as the oxygenation of the blood. But to obviate this, we may remark, that Man, who neither is nor can become amphibious, can yet suspend his respiration for a space of time nearly equal to six minutes. Now, if an animal in which there exists no special apparatus for that purpose, and aided only by the momentary congestion of the blood in the liver, spleen and branches of the vena portæ, can suspend for so long a time the function of respiration, it is not unphilosophical to suppose, that in those furnished with peculiar organs, such as large venous sinuses, and numerous venous trunks of large caliber, the same function may be suspended for double, treble, or even quadruple the time, without any inconvenience to the animal. It is more difficult to offer the rationale of the phenomenon, and to explain how the collecting of blood in venous trunks and sinuses should enable an animal to dispense with a function, on the continuance of which animal life so immediately depends.

It was very generally believed, previous to the experiments of Bichat, that, in cases of suffocation, generally speaking, the first interruption to the circulation of the blood occurred in the lungs; that, in consequence of this, it accumulated in the pulmonary artery, right side of the heart, and whole venous system. To explain this distribution of the blood after death, in cases of suffocation, some very erroneous mechanical theories were brought forward, affecting to demonstrate, that the impediments to the blood's

course, arose from a compression of the capillaries of the lungs, or from their becoming twisted in a variety of ways. These mechanical theories, like every other mechanical theory which has been applied to vital action, did not stand their ground; but the fact remained unexplained, viz. that, after death by suffocation, the venous system is found gorged with blood, and that the obstruction to the blood's course seems to commence in the lungs. If this view be correct, the advantages to be derived from additional reservoirs for the blood will be apparent; and the fatal effects of suspended respiration may be perhaps in the ratio of the capacities of the two systems of vessels; that is, if the veins be small in caliber, and few as to number, the powers of the animal to suspend respiration will be proportionally feeble, and the distress arising from a suspension of respiration proportionally great. (The distressing sensations occurring in suffocation I consider as chiefly owing to the accumulation of blood in the right side of the heart and in the head). On the contrary, if the venous system be capacious, and more especially if additional reservoirs be annexed, capable of considerable distension, as we find to be the case in some Cetacea, in the beaver, and in the diving birds, as the duck tribe, then there will exist considerable powers of suspending respiration at will. Perhaps we may be allowed to illustrate this speculation, by the fact, well known to physicians, that almost instantaneous relief follows the abstraction of a few ounces of blood, in laborious respiration, occasioned by an obstruction to the passage of the blood through the lungs. The relief follows equally whatever may be the cause of the disease, whether an inflammatory point in the organ itself, or a watery or mucous effusion, causing obstruction.

If we consider the distribution of the blood in the abdo-

minal cavity, we may perceive, that, even in man himself, there exists a certain provision for its sudden accumulation in some of the abdominal organs, as the spleen and liver. We are not yet acquainted with all the physiology of these organs, though the subject has been very excellently investigated by Sir EVERARD HOME, in his various experimental inquiries into the functions of the spleen. It would seem that, during digestion, there is a very considerable accumulation of blood in these two organs, and that, moreover, the spleen is more directly filled with fluids by venous absorption from the cardiac portion of the stomach. I had an opportunity of observing both these facts in the examination of a horse which dropt suddenly dead in the field. The circumstances attending his death were briefly these: he had been hunted during the morning for about five hours of a very hot day, and baited at noon; he was a powerful horse, and his rider did not exceed ten stone weight. As the horses came in very warm from the chase, great care was taken that they should eat previously to drinking water, and they were accordingly allowed to graze for somewhat more than an hour, and then to drink at will. The subject of the present history was observed to do as the rest. The lapse of a few minutes occurred at saddling, and they were rode off gently at a moderate trot; but before proceeding three hundred yards, the animal began to stagger, drew up his legs under him, and in a few seconds expired. Naturally anxious to ascertain the cause of death, I examined him immediately after. The heart and lungs were apparently sound, the stomach quite full of food, *but did not contain a drop of liquid*; the spleen moderately full of blood; but we all observed the deficiency of blood in the integuments and in the abdominal viscera generally, as also in the limbs, so much so, that no blood followed the incisions by which the abdominal and thoracic cavities were

exposed. An explanation, however, of this soon offered, for, on plunging the knife into the liver, the blood gushed out in such quantities as presently to fill the whole abdominal cavity; it seemed as if the entire mass of blood naturally belonging to the animal had been accumulated in this viscus only. The real cause of death seems to me obscure; but the facts are valuable in so far as they illustrate the physiology of these organs.

The observations I have had the honour to detail to the Society seem sufficient to establish, as a general theory, that the power of suspending respiration, possessed by aquatic animals, is connected with a peculiar formation of their venous system. An ingenious friend, Mr Thomas Hodgkins, has endeavoured to shew, that the spleen, in man, is intended as a reservoir for the blood, in cases of altered circulation; but it is probable that the whole system of the *vena portæ* assists in this function. Moreover, if this were really a function peculiar to the spleen, we ought to find this organ proportionally largely developed in aquatic animals, which is not the case.

I have already remarked, that there exist valves at the mouths of the *venæ cavæ*, where they expand into the right auricle of the heart. The physiology of these valves is not very well understood, and must necessarily remain obscure, from the circumstance of their being occasionally absent or present, without any general law explanatory of this fact having been traced. Every anatomist knows, that in man the Eustachian valve is sometimes very large in the adult, at other times scarcely perceptible. It exists in animals of various classes, without our being able to trace any connecting physiological theory.

In all the animals I have dissected, it has uniformly appeared to be strictly membranous, and to bear a close resemblance to other valves found in veins. It is incom-

plete, constituting only a semicircle, and can never shut the orifice of the vein against the reflux of blood from the right auricle. From these observations, I have been long in the habit of considering these semi-valves as quite analogous to the other valves of the venous system; but I readily admit, that much more extended researches into the comparative anatomy of these organs are required, before the physiologist can venture to decide on their functions.

XLVI.—*Speculations in regard to the Formation of Opal, Wood-stone, and Diamond.*

By Professor JAMESON.

(*Read 22d February* 1823.)

I SHALL now offer a few observations on the natural history of the Diamond, with the view of shewing that its geognostical distribution and modes of formation are probably more varied than has been generally believed. As opal and hornstone agree in many of their geognostical relations with carbon, the essential ingredient of diamond, we shall first trace the various modes of distribution of these minerals, and then those of the diamond, in order to shew that they have been formed in the same manner, and that all of them appear to be still forming on the surface of the earth, in the newest alluvial formations, and probably even in vegetables.

1. *Opal.*—Opal, which is a hydrate of silica, and eminently distinguished by the beauty of its range of external characters,—occurs in small veins and imbedded portions,

in various primitive rocks. But its principal distribution is in rocks of the secondary class, particularly in traps and porphyries. In these it is arranged in veins, drusy cavities, and imbedded masses, and assumes the various forms of precious opal, common opal, semi-opal, wood-opal, and menilite. The menilite and wood-opal are the most modern of these,—the first occurring imbedded in the adhesive slate of the Paris formation, the other in tuffaceous rocks, of the nature of trachyte. The opals are found sometimes so soft, that they can be flattened between the fingers. The alluvial rocks are not without opal, for it is daily forming by deposition, from the waters of various springs, particularly hot springs, as those of Iceland. From the magnitude and abundance of these springs, in many regions of the earth, and the quantity of siliceous matter they deposite, we can form a general estimate of the great quantity of opaline matter formed in this way. We have now traced opal, from the primitive to the newest rocks, thus proving that it is one of those minerals which have an extensive geognostical range, and which are still forming in the mineral kingdom; but one of the most interesting features in its natural history remains to be noticed. I allude to its formation by the organic powers of plants. It is well known to botanists, that silica occurs in considerable abundance in several tribes of plants, and that it communicates to the parts of the plants containing it, a considerable degree of hardness. The Bamboo is one of the most remarkable in this respect, as the earth it contains occurs not only in the vegetable structure itself, but is secreted from it, and appears in the joints of the plant, in solid masses, named Tabasheer, and which bear a strong resemblance to opal. We have thus shewn that opal is a formation of primitive, secondary, and alluvial strata; and finally, that it is a product of vegetables.

2. *Hornstone.*—We shall next trace the distribution and formation of hornstone. This mineral, which, in its pure state, is principally composed of silica, occurs in considerable abundance in several primitive rocks. It appears also in rocks of the transition-class, and is associated with different secondary rock formations. Wood, penetrated with hornstone, occurs occasionally in alluvial strata, as in clays and sands of various kinds, and exhibiting such characters, as shew that the petrifaction or penetration of the wood with the hornstone, had taken place in it after it was enveloped in the clays and sands. Like opal, hornstone seems to be a product of vegetable origin; for the specimen which I now exhibit to the Society is a variety of woodstone. This remarkable specimen, which is 18 inches long, 5 inches thick, and 8 inches broad, was torn from the interior of a log of teakwood (*Tectona grandis*), in one of the dock-yards at Calcutta. The carpenters, on sawing the log of teakwood, were arrested in their progress by a hard body, which they found to be interlaced with the fibres of the wood, and, on cutting round, extracted the specimen now on the table. This fact naturally led me to conjecture, that the mass of woodstone had been secreted by the tree, and that in this particular case, a greater quantity of silica than usual had been deposited; in short, that this portion of the trunk of the tree had become silicified, thus offering to our observation in vegetables, a case analogous to the ossifications that take place in the animal system. I was further led to suppose, that this wood might contain silica in considerable quantity, as one of its constituent parts, a conjecture which was confirmed by some experiments made by Dr WOLLASTON. Other woods appear also to contain silica, and these, in all probability, will occasionally have portions of their structure highly impregnated with silica, forming masses which will

present the principal characters of petrified wood. Indeed, I think it probable, that some of the petrified woods in cabinets, are portions of trees that have been silicified by the living powers of the vegetable, and not trunks or branches which have been petrified or silicified by a mere mineral process.

3. *Diamond.*—Having now shewn that opal and hornstone extend in this series of rock-formations, from the primitive to the newest alluvial rocks, and that both appear to be forming in vegetables of particular kinds, we shall next endeavour to shew that the same is probably the case with the diamond. The diamond, as is well known, is carbon in a pure and highly crystallised state,—and although carbon is a very generally distributed substance, it has hitherto occurred but very sparingly in its pure and crystallised state, or in that of the diamond. Primitive rocks, of almost every description, contain carbon,—either in the state of an acid, forming carbonic acid, as in the carbonates of lime and magnesia,—or in the state of an oxide, as in glance or metallic coal,—or in graphite or black lead, which is also an oxide of carbon, but of a different nature from that in glance-coal,—and, from information lately obtained from India, even carbon, in its purest state, in the form of diamond, is said to occur imbedded in a conglomerated quartz, subordinate to clay-slate.

Greywacke, and other rocks of the transition class, contain graphite and glance-coal, but hitherto have afforded no traces of the diamond. Graphite and glance-coal occur in considerable beds in formations of the secondary class. The diamond, according to different authors, is met with in trap-tuffas, in sandstone, and in amygdaloids of the secondary series. But the geognostical distribution of this gem does not appear to terminate here, for we are assured by those who have attended to its situation in the

earth, that it is found in alluvial beds of clay, not as a secondary deposite, but as an original one; in short, that the diamond continues to form, or to use a more common language, to grow in alluvial districts in India. This opinion is not improbable, and nothing more seems to be necessary for the formation of the diamond in such situations, than time, or other favourable circumstances, for allowing portions of the carbonaceous matter in the soil to be reduced to the adamantine state, and afterwards to coalesce, according to the laws of affinity, into the granular and crystallised form,—in short, to form diamond. The gradual formation of calcareous grains, crystals and masses of calcareous spar in clays, of siliceous compounds in similar rocks, appears to be occasioned by the gradual concentration of the calcareous and siliceous particles by some attractive power, in the same manner as we conceive diamonds may have been formed by the concentration of particles of carbon.

The preceding details, in regard to opal and hornstone, naturally lead us to inquire, if it is probable that the diamond, like these substances, is occasionally formed by the powers of vegetation? Reasoning *à priori*, we would say it is much more likely that some plants would produce diamonds, than that they would secrete siliceous matter in a state fit to form opal and hornstone, because diamond is but carbon, the principal constituent part of plants, in a peculiar state; whereas the silica of the opal and hornstone are subordinate ingredients in vegetation. But a direct appeal to the characters of some woods seem to countenance the idea I some years ago suggested in the Society, that vegetables may contain carbonaceous matter approaching to the adamantine state. Certain woods which have not the gritty feel of those that contain silica, are uncommonly hard, dark-coloured, and take a high polish;

these I conjecture, may be somewhat of an adamantine nature. If this should prove to be the case, it would neither be surprising nor unexpected, that such trees may secrete carbon in the adamantine state, which, on being removed from the influence of the living principle of the plant, would, by the power of affinity, form into true diamonds,—just as the silica secreted from the bamboo takes the form of opal, and that from teakwood the characters of hornstone.

The preceding statement, then, seems to give plausibility to the idea, that some sorts of trees may be characterised by the power of forming a mineral matter of the nature of hornstone; that others secrete silica, which assumes the character of opal; while others may possess the power of secreting and forming diamonds.

It may be added, that the carbonate of lime, which occurs in all the rock formations, from the primitive granite to the newest alluvial formation, is one of the mineral substances secreted by vegetables. Some lichens and the chara tribe afford remarkable examples of this fact.

XLVII.—*Notice regarding the Map of Mackenzie's River by Mr W. F. Wenzel, of the North-West Fur Company.*

(*Read 22d March* 1823.)

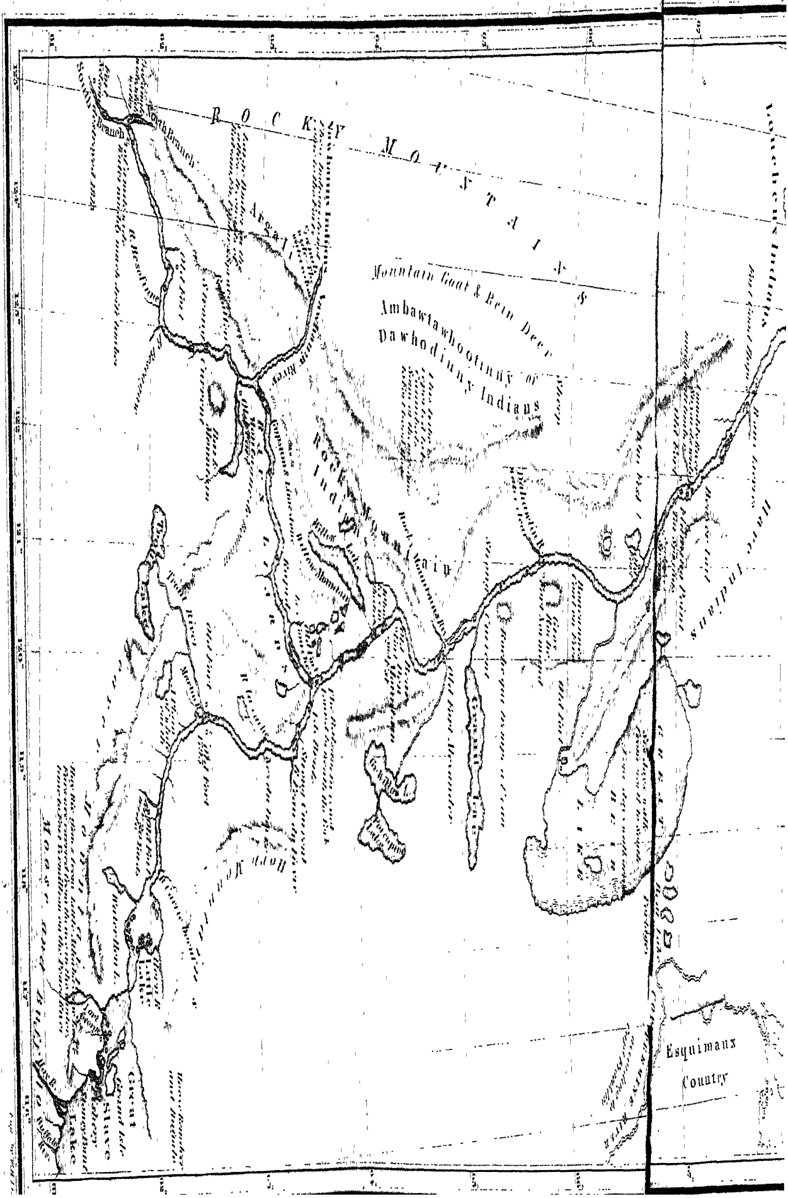
THIS valuable map was transmitted to Professor Jameson, for publication in the Society's Memoirs, and is the most satisfactory delineation of the celebrated Mackenzie's River hitherto presented to the public. Besides the details in the map itself, others of importance are contained in the article " On the attempts to reach the Sea by Mackenzie's River," published in the first part of the present volume of Memoirs. In addition to these the following notices have been communicated.

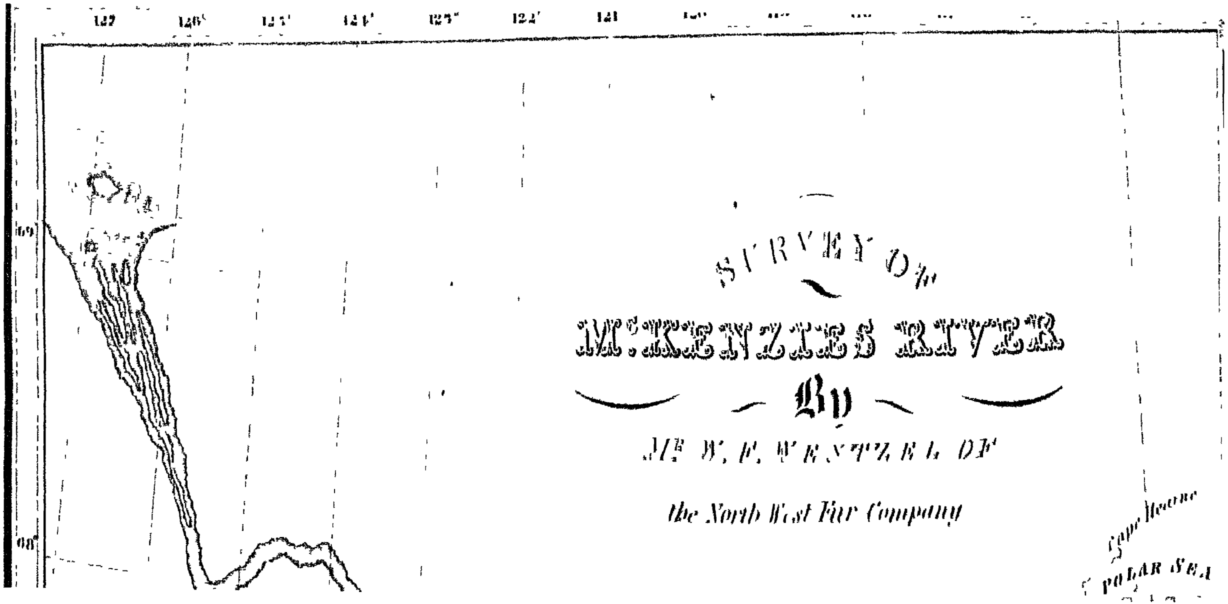
Horn Mountain Indians, are a tribe of the Dog-rib nation. They speak the Chepewyan language, amount to about 600 souls, and inhabit the country between Great Bear and Slave Lakes.

Hare Indians speak a dialect of the Chepewyan, but their number is unknown.

Loucheux Indians perforate the septum of their nose, resemble the Esquimaux in their dress, and are supposed to speak a dialect of the Esquimaux language. Number unknown.

PLATE XVII.


ROCKY MOUNTAINS
Mountain Goat & Rein Deer
Ambawtawhootinny or Dawhodinny Indians
Esquimaux Country
Hare Indians
Great Slave Lake
South Branch
North Branch


SURVEY OF
M'KENZIES RIVER
By
MR W. F. WENTZEL OF
the North West Fur Company
Cape Hearne
POLAR SEA
69°
68°
127
126°
124°
121

Rocky Mountain Indians. Number about 160 souls,—speak a dialect of Chepewyan.

Strong-Bow Indians. They frequent the country from Fort Nelson to the forks of Mackenzie's River, and muster about 280 souls. They speak Chepewyan, as do all those tribes that are known in that quarter, except the Loucheux.

Ranges of Mountains.—The natives speak of there being eleven distinct ranges of the Rocky Mountains, which lie parallel to each other, and have a general direction from north to south.

Edible Earth.—An edible earth is found below the *forks*, which is described as unctuous clay, which the Indians eat from choice.

Meteoric Stone.—The Strong-Bow Indians observed a meteoric stone, several feet in diameter, to fall from the sky. It had a bad smell, and its fall was attended with a report like thunder. The year is unknown, but it was since 1795, when the traders first established themselves there.

Petrifying Spring.—There is a petrifying spring about forty miles above the forks. The petrifactions are as white as snow, and the spring issues from a stone of a light-grey colour, which is used for grinding tools, and is supposed to be a kind of calcareous sandstone. The river cuts this bed of stone into two, and produces a small cascade.

Flints or *Calcedonies.*—Above the Montagne de Bouleau, on the Riviere aux Liards, there are many stones described as flints, but which appear, in general, rather to be varieties of calcedony; the colours are black, blue, milk-white, and veined, clouded and striped; the blackish varieties are softer than the others; and all have a thin yellowish coat or crust. Flint or calcedony is found in all parts of Mackenzie's river, and is used by the natives to tip their arrows with.

XLVIII.—*Observations on some Species of the Genus* Vermiculum *of* MONTAGU.

By the Rev. JOHN FLEMING, D. D. F. R. S. E. M. W. S. &c. Minister of Flisk.

(*Read 5th April* 1823.)

IN the "Testacea Britannica," the late Mr MONTAGU, in the first section of his genus Vermiculum, has given a description of five shells, which now belong to the more recent genus *Miliola*. These descriptions, however, are scarcely sufficient to enable the young conchologist to identify the species, even when assisted by the figures which he has added, or those of WALKER, in the "Testacea minuta rariora," to which he has referred. In order to establish satisfactory specific characters, the permanent conditions of the mouth must be attended to, rather than the variable forms of the chambers. Under this impression, I shall here give the distinguishing marks of four species, accompanied by figures of their appearance when magnified.

1. *V. intortum*. Test. Brit. 520. Mouth compressed, with a simple tooth attached to the side next the body.

Plate XV. fig. 3. *a* and *b*, each side of the body; *c*, the mouth; *d*, a lateral view of the tooth.

This species appears to be the *Serpula seminulum* of LINNÆUS,—the *Serpula subovalis umbilico pervio* of WALKER, Test. Min. tab. 1. f. 1.,—and the *Serpula ovalis* of ADAMS, Linn. Trans. vol. v. p. 4. tab. 1. fig. 28. 29. 30. The shell is in general a little compressed, and the external margin subacute. Three chambers are usually visible on one side, and four on the other. These are slightly striated across, and have the limits of separation well defined. The tooth is a triangular thin plate, a little recurved at the tip, and so persistent as frequently to remain after the outer side of the chamber has been destroyed.

2. *V. oblongum.* Test. Brit. 522. tab. 14. f. 9. Mouth round, with a pedunculated forked tooth. Plate XV. fig. 4. *d*, *e*, each side of the body; *f*, the mouth and tooth.

Three chambers are usually visible on one side, and two on the other. In the first, the middle chamber is partially embraced by the outer ones, so that a shallow depression is formed at the outside of the line of junction. On the other side of the shell a similar depression is observable, and produced by the margin of the last chamber rising on the side of the second. The chambers are rounded externally.

3. *V. subrotundum.* Test. Brit. 521. Mouth depressed, toothless. Plate XV. fig. 5. *g* and *h*, each side of the body; *i*, the mouth.

This appears to be the *Serpula subrotunda dorso elevato* of WALKER's Test. Min. tab. 1. f. 4. This shell differs from the two preceding species in being globular. The chambers are three, sometimes four in number, inflated and wrinkled. The fourth chamber, when present, seems always imperfectly formed.

These three species occur on corallines, &c. in abundance on all parts of the coast. They are slightly translucent and glossy, when recent, but, like other shells, they become after death opake and dull by maceration. They seldom exceed the tenth of an inch in size. Their inhabitants are unknown. The *V. bicorne* (including the *V. perforatum* as a synonyme) has never occurred to me.

4. *V. lacteum.* Test. Brit. 522.

This species differs so widely from the preceding ones in structure, as to justify us in considering it as the type of another genus. In these, the second chamber is placed at the end of the first, in such a manner as that its mouth has the same aspect as the base of the preceding one. The base of the third chamber, taking its rise from the mouth of the second, stretches along the remaining side of the first, and has its mouth formed so as to possess the same aspect. Thus the mouths of the chambers are placed alternately at the opposite ends of that line which is parallel with the direction of growth. In the *V. lactea*, on the other hand, the cells are arranged obliquely and alternately along an axis, with the mouths of all the chambers always having an aspect towards the same pole, as is represented at Plate XV. fig. 6. where *k* and *l* are representations of each side of the body, and *m* of the mouth.

The chambers are ovate, and well defined on one side; but they appear less numerous and distinct on the other. The chambers become narrower towards the mouth, which is in the form of a small circular aperture. The whole shell is delicately transparent, with the inner walls of the chambers appearing as white veins. The specimen figured by Walker as *Serpula tenuis ovalis lævis* (Test. Min. tab. 1. f. 5.), is probably a young individual. I am, however, more disposed to refer the species before me to the *V. lac-*

teum, from the character of being pellucid, with milky veins, than from its resemblance to the figure quoted. A remark, indeed, of Montagu, who was in possession of the specimens and the drawings of Walker, weakens the confidence we might otherwise have been disposed to place in the accuracy of the engravings in the Test. Min. "Indeed we perceive so considerable a difference between the original drawings of this (*Nautilus calcar*) and other shells of Walker, and the engravings taken from them, that we should scarce have known them to be the same, had they not been marked with the same numbers." Test. Brit. p. 190. I have only observed this species in sea-sand from Zetland.

Manse of Flisk,
April 14. 1823.

XLIX.—*Notice in regard to Marine Shells found in the Line of the Ardrossan Canal.*

By Captain LASKEY.

(*Read 8th January* 1814.)

ON cutting through a bed of sand and clay, which is about forty feet above the level of the present bed of the Clyde, nearly four miles from Glasgow, and in the line of the Ardrossan Canal, a considerable accumulation of marine shells was met with. The sands and clays are of the same nature with those that form the immediate shores and bottom of the Clyde, and hence it is probable that they were deposited in their present situation by the salt waters of the Frith of Clyde. This opinion is further illustrated by historical tradition, for it is reported that vessels of large size were at a former time able to navigate the Clyde beyond Rutherglen; and we are told that the remains of a boat were found at the depth of twelve feet, in digging out the foundation of the Tontine Inn in Glasgow, which is at present at a considerable distance from the banks of the river. The following shells were collected:

Turbo littoreus.
rudis.
teretra.
Arca minuta.
nucleus.
Patella pellucida.
vulgaris.
Buccinum lapillus.
Mytilus edulis.
Pecten opercularis.
Venus Islandica.
Venus striata.
literata.
Balanus communis.
Buccinum undatum.
Anomia ephippium.
Tellina plana.
Cardium echinatum.
Nerita littoralis.
glaucina.
Mya truncata.
Trochus crassus.

All these still inhabit the Frith of Clyde and its shores, but occur only below Dumbarton, or where the water is constantly salt.

APPENDIX.

HISTORY

OF THE

SOCIETY.

(*Continued from Vol. III. p.* 541.)

IN consequence of the unusual number of visitors to-day, desirous of witnessing the opening of the Mummy from Thebes, presented to the Museum of the University by Colonel STRATTON, it was found necessary to adjourn from the Hall of the Society, and to delay the reading of the papers announced. 1821. Jan. 27.

In the lecture-room of the Professor of Natural History, the Mummy was opened by direction of Colonel STRATTON, who was present, and gave various explanations. It proved to be a female of the Arab-European race, and of very high antiquity.

Professor JAMESON read a notice by Mr Blackadder, W. S. of the Sounds emitted by Woods or Forests on the approach of Storms; likewise a communication from the Rev. Mr Jameson regarding a remarkable Scotch Terrier. Mr Deuchar continued his Account of Experiments on Feb. 10.

Flame, made with Colonel Yule's apparatus for discharging ordnance.

1821. Feb. 24. Mr Bald read an Account of the Discovery of an Elephant's Tusk in an alluvial clay, in the course of digging the Union Canal. The Secretary read a note communicated by Mr Trevelyan, of an Experiment made at Howick, by inclosing a living Toad in a small chamber under ground for the space of more than two years, at the end of which time the animal appeared as healthy as when inclosed. Professor Jameson read the first part of an account of the *Proteus anguina*, by Signor Configliachi, communicated by Daniel Ellis, Esq. A fine specimen of the Musk Ox, shot on Melville Island by Captain Parry, and presented to the Royal Museum of the University by Lord Melville, was exhibited; and the preparation having been made with great care and success, excited general admiration. Professor Jameson, at the same time, made some remarks illustrative of the habits and manners of the animal.

1821. March 10. Mr Trevelyan read a Geognostic Account of the Rocks in the neighbourhood of Bamborough Castle, accompanying his description with Specimens and Plans. Dr Knox read a notice respecting a Caffre Albino. Mr Deuchar laid before the Society the conclusion of his Experiments on Flame, and also gave an Account of three very large Loadstones brought from Moscow.

1821. March 24. The Secretary read Mr Edmondston's Account of a new Species of Gull from Shetland, the *Larus Islandicus;* likewise, Remarks by Mr Burke on a Tartar Book, presented by the Marquis of Hastings to Professor Jameson, for the College Museum; and Notices, by Mr Trevelyan, of some remarkable Hail-showers which have of late years

occurred in England. Professor Jameson then gave a General Account of Mr Anderson's Geognostic Survey of the Country around Inverness, and of the Great Glen of Scotland, illustrating his description by a reference to a Plan of the district. The Professor then exhibited a very fine prepared specimen of the Tapir of Malacca, and the Jungle-Cock of India, making remarks on the habits of these animals.

The Funeral of Professor Dr Gregory having been fixed for this day, the Society did not proceed to business, but immediately adjourned the Meeting till next Saturday, the 14th instant. 1821. April 7.

The Secretary read an account of Meteorological Observations made at Clunie, in Perthshire, by the Reverend Mr Macritchie; also the Description of a very large Fossil Reed, or Tree, which occurred in the sandstone of the Coal Formation on the coast of Northumberland, illustrated by an Etching by Mr Trevelyan; and a Notice regarding the Extent of the Plantations of the Duke of Athol in Perthshire, by Mr Graham. Professor Jameson then gave the Society an account of a Map of the Interior of Africa, illustrating the Course of the Niger, constructed by Mr Macqueen of Glasgow; and also read a Series of Observations on the Metamorphoses of some of the minute Algæ. April 14.

The Secretary read a Biographical Memoir of the late Dr William Wright, communicated by the Doctor's relatives. Professor Jameson then read a communication from Dr Fleming, describing the growth of a plant resembling a Trichia, in a solution of succinate of ammonia, illustrated with a drawing. April 21.

1821. May 19. Professor Jameson read a series of Meteorological Observations made at the Cape of Good Hope, by Dr Knox. The Secretary then read a Notice by Mr Falconar regarding the *Tulipa oculus solis*, and also exhibited a flowering specimen of *Iris sordida* from Carlowrie. Mr Deuchar then read his Explanation of a Cause for the Occurrence of Drops of Water in the interior of regularly shaped Crystals.

Nov. 17. The Secretary read two communications from Captain Scoresby junior; one containing further Remarks on the Impregnation of Wood by Sea-water, when sunk to great depths; and the other on the Cause of Fogs in the Greenland Seas. Likewise a Letter from Dr Fleming to Professor Jameson, giving a short account of an Excursion round the North-West of Scotland; and also a Letter from Mr Anderson to the Professor, stating correctly the Boundaries of the District of Primitive Rocks in Orkney. Professor Jameson communicated to the Society a Letter from Dr Oudney, mentioning the object of the Expedition to Africa, in which he was about to embark: also a Note from Mr Barrow, secretary to the Admiralty, relative to the Progress of the Arctic Overland Expedition; and Extracts of a Letter to Professor Jameson, from Dr Richardson, Naturalist to the Expedition, giving an Account of the general Geognostical Features of the Country they had traversed.

Dec. 1. Professor Jameson laid before the Society a communication on the Crystallisations of Copper-Pyrites, by Mr Haidenger of Freyberg.

Dec. 15. The Secretary read, 1*st*, A Notice regarding the Fossil Animal of Whitby, contained in a Letter from the Rev. Mr Young, addressed to Professor Jameson; 2*d*, Meteorological Observations, made during a long residence on the

north side of the Island of Jamaica, by Dr Arnold; and, *3d*, Observations, by Captain Wauchope, R. N., on the Temperature of the Ocean at different Depths,—on the Indications of the Weather, afforded by the Barometer, off the Cape of Good Hope,—and on the Under-Currents observable in the Ocean, generally flowing in a direction different from the Surface-Current. Dr Yule then read some Remarks on the *Calamus Rotang*, a very fine specimen of which, originally 250 feet in length, was exhibited.

The Secretary read a Letter, from Mr Young of Whitby to Professor Jameson, containing a further Account of the Bones of Elephants, Hyænas, &c. found in the Kirkdale Cavern, Yorkshire; 2. A Letter regarding the Arctic Land-Expedition, communicated by the Earl of Dalhousie, Governor of Canada, to Principal Baird, dated 16th April 1821, at the Winter-quarters (Fort Enterprize) of the Expedition, in Lat. 64° 28′, and W. Long. 113° 0.6, being 133 miles directly North from Fort Providence, and 56 geographical miles South of Copper-Mine River, which had been visited by some of the party, and reported to be navigable. Mr Greville then read an Account of several Fungi new to Scotland. 1821. Dec. 29.

Mr Greville read the Description of a new species of Grimmia found in the King's Park at Edinburgh. The Secretary read Extracts from Mr Selby's List of Birds which occur in Northumberland; likewise the first part of Dr Adam of Calcutta's Account of a District of Country between the Jumna and Nerbuddah; and a Letter from Mr Bald relative to the Girvan Coalfield in the south-west of Scotland. 1822. Jan. 12.

1822. Jan. 26. Professor Jameson read Dr Boué's Account of the Rocks of Germany, illustrating the demonstration by sketches, &c. The Secretary read the account of the Diamond Mines in the district between the Jumna and the Nerbuddah, by Dr Adam of Calcutta. Mr Greville gave an account of Two New Plants of the Order *Algæ*, found in Scotland; and the Reverend Mr Nelson read Extracts of a Letter from Dr Oudney, one of the gentlemen sent by Government to explore the Interior of Africa, dated Tripoli, the end of October last.

Feb. 9. The Secretary read a communication from Mr Macgillivray, describing Two remarkable Varieties of the *Nuphar lutea*, found in the Corby Loch, near Aberdeen. Professor Jameson read a notice in regard to Twin-Crystals of Sulphat of Lead. The Professor next gave an account of the second part of Dr Boué's Memoir on the Rocks of Germany. A fine specimen of the Snowy Owl (*Strix Nyctea*; shot in Zetland by Mr L. Edmondston, was exhibited.

Feb. 23. Mr Greville read the first part of a Memoir, by himself and Mr Arnott, on a New Arrangement of the Genera of Mosses, according to their natural affinities. Professor Jameson communicated an interesting notice, by Mr Murray of Symprim, in regard to the Non-existence of Fossil Human Remains in Europe; and a Geognostical Description of the Country around St John's in Newfoundland, by Mr John Baird, illustrated by sketches.

March 9. The Secretary read a communication from Dr Grierson of Cockpen, on the Natural History and Habits of the Common Mole; likewise an Account of the Phænogamous Vegetation and of the Birds observed along the Banks of

the Dee, from its sources in Braemar to its mouth at Aberdeen, by Mr Macgillivray.

1822. March 23.

The Secretary read two communications from Mr Laurence Edmondston of Unst, in Zetland, in regard to the Snowy Owl, and the Icelandic Gull. Professor Jameson then read an Essay on the Distribution of Fossil Organic Remains, as connected with the Theory of the Earth.

April 6.

Mr Greville gave an account of four new species of Peziza found in Scotland, illustrated by drawings. Professor Jameson read a notice from Captain Scoresby jun. regarding recent Experiments made by him on the remarkable Effects of Percussion on Steel in producing strong Magnetic Powers. The Professor also read an account of Tiedemann's Comparison of the Brain of Man with that of Apes, Seals, Whales, Bats, and other Animals of the Class Mammalia. The Secretary then read a notice regarding the Northern and Speckled Diver, by Mr L. Edmondston.

April 20.

Professor Jameson read a short account of the Tusk of a Fossil Elephant dug up in Lincolnshire, illustrated by a drawing of the Tooth. He then gave an account of the various Strata, Beds, and Veins around Lochgilphead, illustrating his descriptions by sketches. The Professor likewise read extracts of a letter from Dr Oudney, dated Tripoli, 24th January last. The Secretary read a notice of a remarkable Hail-Storm in Essex: likewise extracts of a letter from Mr Strang of Lopness, in Orkney, describing some singular Effects of the violent Gales in that quarter. He also laid before the Society a Thermometrical Register taken every hour of the day and night, between 6 A. M. of 1st April and 6 P. M. of 6th April: the general results were, that generally the minimum was at 6 A. M., and the

maximum at 6 P. M.; that the average rise was 2.3, the fall 2.12; that on the night of the 4th and morning of the 5th April the temperature was stationary for five hours; and that the average temperature of each day was the same nearly as what was observed at 8 A. M. and 8 P. M.

1822. May 12. The Secretary read a paper on the Arctic Gull, by Mr Edmondston; and a notice regarding some Habits of the Common Mole, by Mr Stark. The Reverend Mr Young of Whitby being present, read his Account of Caverns in Yorkshire which contain Remains of Animals.

May 18. Professor Jameson read to the Society Captain Vetch's Account of the Island of Foula, one of the Shetlands. He also read a notice relative to the Cannibalism of the Battas, in the interior of Sumatra, communicated by a gentleman now engaged in surveying the Indian Islands; together with an Account of the Dryobalanops, or Sumatran Camphor-Tree. The Professor likewise read extracts from a Memoir presented by Dr Daubeny, on the methods of separating Magnesia from Lime, and on its Distribution through Rocks of the Transition and Secondary classes. Mr Deuchar read an account of some Experiments on Glass; and the Secretary communicated some Observations on the Greenland Kittiwake and Colymbus Grylle, by Mr L. Edmondston.

August 10. An Extraordinary Meeting was held this day, in order to vote a Congratulatory Address to His Majesty King GEORGE the FOURTH, on occasion of his Visit to Scotland. The same being agreed to, and prepared, the President was requested to present it to His Majesty at the Levee to be held at Holyroodhouse. The Society at the same time directed a copy of the Memoirs of the Society to be presented along with the Address. The following is a copy of the Address:

"*To the King's Most Excellent Majesty.*

"MAY IT PLEASE YOUR MAJESTY,

"WE, your Majesty's most dutiful and loyal Subjects, the Members of the Wernerian Natural History Society of Edinburgh, beg leave to approach the Throne with the warmest sentiments of congratulation on the happy event of your Majesty's condescending Visit to this part of the United Kingdom; an event which will be recorded as forming a brilliant and memorable era in the Annals of Scotland.

"Amongst the various descriptions of our Countrymen, who are now so eagerly pressing forward to testify their veneration and attachment to your Majesty, we, too, would humbly hope that the tribute of loyalty, gratitude, and affection, cordially presented by a Body of Men who have associated for the cultivation of one of the most beautiful and useful of the Sciences, will not be unacceptable to a Prince who, besides possessing the noblest qualifications of a Sovereign, is so eminently distinguished by his knowledge, taste, and personal accomplishments, and who is, we believe, himself an admirer of our favourite study. It is, indeed, one of the greatest glories of your Majesty's Reign, that you have evinced an ardent desire to assist the progress of Science, Art, and Literature, in all their departments.

"On this occasion, so important and auspicious to our Native Country, permit us, in common with all the other classes of your Majesty's faithful subjects in Scotland, to assure your Majesty, that we deeply feel the unrivalled blessings which we enjoy under your Majesty's mild and paternal Government; and that we reflect with pride and joy on the unparalleled lustre which has been shed on your Majesty's Reign, by the firmness of your character, the wisdom of your councils, and the vigour of your arms; which, under Providence, have exalted our Country to the highest rank among the nations of Europe, and placed the security, the glory, and prosperity of the British Empire, on a basis never, we trust, to be moved.

"That Your Majesty may long be spared to fill the Throne which you so nobly adorn, to enjoy the affection of a People by whom you are so justly beloved and revered, and to cherish, as their munificent Patron, those Sciences and Arts which have so eminently contributed to the glory and prosperity of the Empire, is the earnest prayer of,

"May it please Your Majesty,

"Your Majesty's most loyal and devoted Subjects,

"The Members of the Wernerian Natural History Society of Edinburgh.

"Signed in our name, and by our appointment, by

"ROBERT JAMESON, President."

EDINBURGH, 12th *August* 1822.

1822. August 24. *Memorandum.*—The above Address, and a copy of the Society's Memoirs, were presented by Professor Jameson, the President of the Society, to the KING, at the Levee held by His Majesty at Holyroodhouse, on Saturday the 17th August,—most graciously received, and afterwards published in the Edinburgh Gazette of Friday 23d August.

Nov. 16. The Secretary read Mr L. Edmondston's List of Birds observed in the Shetland Islands, additional to those recorded by Authors: also Mr Don's paper on the Melastomaceæ, including Descriptions of Eleven new Genera. Dr Hibbert then gave an Account of the Natural Expedients resorted to by a Boy in Cheshire, for supplying the Want which he has sustained since Birth, of his Fore-Arms and Hands. The Secretary read two communications from Lord Gray, now in Italy, containing Notices of the Experiments of the Chevalier Morozi of Milan, on the Excitation of Heat by Friction, and on the Mode of soldering Broken Pieces of Cast-Iron. Professor Jameson read a Letter from Dr Oudney, dated Mourzuk, in June last.

Nov. 30. The Secretary read Mr Young's paper on the Mode in which the Remains of Quadrupeds may have been brought together in the Kirkdale Cavern, Yorkshire. Dr Charles Anderson read a Description of a new Drop-Measure. Professor Jameson then communicated Extracts of a Letter from Dr Traill of Liverpool, and from Capt. Scoresby jun. giving a General Account of Discoveries made by Captain Scoresby, during last summer and autumn, on the East Coast of West Greenland, he having explored a stretch of about 700 miles of nearly unknown coast. He was within 200 miles of the presumed site of the lost colony: he every

where met with traces of inhabitants, without, however, seeing any. He found in some parts of the coast a line of open sea, about 20 miles broad, caused by the influence of the sun, between the shore and main body of ice; thus giving reason to hope that Captain Parry may, by keeping close along the shores, make good his passage, next season, round Icy Cape, into the Pacific Ocean. The Professor then read an Account of a new species of Lophius (*L. histrio*) of the West Indies, by the Reverend Mr Guilding of St Vincent's; and he also communicated a Notice of a Mammoth's Tusk, 6¼ feet long, dug up at Rugby, in Warwickshire, the Tusk being at the same time exhibited.

Professor Jameson communicated Observations on subjects connected with Natural History, made in a Voyage round the North of Scotland, by Dr Fleming; likewise the Account of a Marine Deposite on the margin of Loch Lomond, by Mr James Adamson. The Professor also gave a short Account of the Zeus Luna, or King-Fish, a very fine and full-grown specimen of which had been taken in the Frith of Forth, and presented to the College Museum by the Earl of Wemyss, and which was now exhibited to the Meeting. 1822. Dec. 14.

The Secretary read the first part of the Journal of a Visit to Adam's Peak, in Ceylon, by Mr Henry Marshall, Staff-Surgeon. Mr Greville then communicated his Account of the Esculent Fungi of Great Britain. Dr Knox read a Notice in regard to the Habits of the Hyæna of Southern Africa. And Dr Yule communicated specimens of Maize ripened in Scotland, and made some Observations on the practicability of naturalising that grain. Dec. 28.

1823. Jan. 11. The Secretary read the second part of the Account of a Journey to Adam's Peak, in Ceylon. The Hour-Cup, which belonged to the King of Kandy, was exhibited, and found to sink in water in about 28 minutes of our time, being the Cinghalese Hour. The Secretary also read an Abstract of a Letter from the Reverend William Dunbar of Applegarth to Principal Baird, confirming the Doctrines of Schirach and Huber respecting Queen-Bees. He likewise read a Proposal for an Improvement in the Form of Cannon-Balls, calculated to communicate the advantages of projecting them from a Rifled Barrel, by M. Miller, Esq. of the 51st Regiment. Dr Hibbert then read an additional Account of the Expedients resorted to by a Boy in Cheshire, to supply the Deficiency of Fore-Arms and Hands, and presented a Portrait of the Boy. Mr Innes of Stow exhibited to the Meeting some admirable specimens of Drawing and Ornamental Penmanship, by Mathew Buckinger, who was destitute of Hands and Feet: these specimens were dated Edinburgh 1723.

Jan. 25. The Secretary read a paper on the Identity, considered as species, of the Golden and the Ring-tailed Eagles, by Mr Selby. Professor Jameson read a notice of a remarkable Thunder-storm in Berwickshire, in the course of which all the surrounding objects assumed the colour of copper. He then exhibited the Horn of a Rhinoceros, found in one of the Marl-pits at the Loch of Forfar. He next laid before the Society the Skeleton, and also the Stuffed Skin, of the Dugong of Singapore. He likewise read Dr Traill's Remarks on American Animals of the Genus Felis. A live specimen, in fine condition, of the Ichneumon, belonging to the Reverend Dr W. Ritchie, was then shewn to the Members.

Dr Macdonald read a short account of the Geognosy of part of the Point of Cantyre. The Secretary read Dr Traill's Account of the Guanaco of South America, and his Description of the Larus Scoresbii; and also a Translation, by the Reverend Principal Baird, from the Chili Gazette, of a Report by Senor Levasse, relative to Human Fossil Remains discovered in South America. Professor Jameson communicated a short paper, by Mr M. Miller, on the Increasing Temperature of the Earth as we descend in Mines. 1823. Feb. 8.

The Secretary read a paper by James Wilson, Esq. on the different Opinions entertained regarding the Specific Distinction or the Identity of the Ring-tail and Golden Eagles; likewise a notice from Mr Selby, concerning some rare Birds which had occurred on the Coast of Northumberland during the great storm in the beginning of February of this year. Professor Jameson then read to the Society Observations on the Modes of Formation of Opal, Hornstone, and Diamond. Feb. 22.

The Secretary read an account of a new Species of Pigeon from New Holland, by Sir William Jardine, Baronet, illustrated by a Drawing; likewise Remarks on the Sertularia Cuscuta of Ellis, by Dr Fleming; and a Notice by Mr L. Edmondston, in regard to the Ivory Gull and Iceland Gull. Professor Jameson communicated to the Society a Register of the Thermometer, Adie's Sympiesometer, and Leslie's Hygrometer, kept at Corfu, by Mathew Miller, Esq. of the 56th Regiment, with Remarks; likewise a Letter from Mr William Jameson, dated Lima, descriptive of his Voyage round Cape Horn, and a Chart of the Course, laid down in the mode recommended by Capt. Basil Hall. March 8.

1823. March 22. Dr Yule read his Observations on the presumed Analogy of certain Organs of the Embryo, in the several distinct Races of Vascular Plants. The Secretary read a paper by James Wilson, Esq. on the Genus Mergus. Professor Jameson read Extracts of a Letter from Dr Oudney, Leader of the African Expedition, dated Mourzuk, 17th September 1822; likewise the first part of Mr Macgillivray's Remarks on the Specific Characters of Birds.

April 5. The Secretary read an Extract from a Letter relative to the appearance of Pompeii, written by Lieutenant Boyd, R. N., and communicated by Mr Arnott; also a Description of a Reversed Species of Fusus, by Dr Fleming. Mr Greville then read Observations on the Formation of Lead-Spars, communicated by Mr Braid of Leadhills. And Mr Deuchar exhibited and explained some curious Experiments on Crystallisation.

April 19. The Secretary read a paper by Dr Knox on the Anatomy of the Beaver; and Observations by Mr Don on a new Natural Family of Plants, to be called Cobeaceæ. Dr Knox then read an Inquiry into the Original and Characteristic Differences of the Native Races inhabiting the extra-tropical part of Southern Africa. Professor Jameson gave an account of a communication from Dr Boué, dated Vienna, in which he controverts the late Observations of Professor Buckland of Oxford, in regard to the Secondary Formations of the Alps of Switzerland, and also detailed his Observations on the Pyrenees, and South of Germany.

April 26. Mr Arnott read a paper, by Mr L. Edmondston, on the Black-billed Auk and Lesser Guillemot, and Professor Jameson described the specimens exhibited. Dr Knox read a paper on some Peculiarities of the Structure of the

New Holland Casuary. A memoir on the Bignoniaceæ, by Mr Don, was read; and likewise the first part of Mr Ellis's Account of Dr Rusconi's Observations on the Natural History and Structure of the Aquatic Salamander. Before the close of the Meeting, Professor Jameson gave an account of a series of Models, exhibited at the Meeting, representing the different Indian Castes in Bengal; likewise some Cinerary Urns, lately dug up at Dean Bank, near Stockbridge. Some remarkable Javanese Deities, and a complete set of Musical Instruments from Nepaul, were likewise exhibited.

The Secretary read Dr Ramsay's Account of Macquarrie Island, and of the Sea-Cow Chase, for which it is frequented; and Dr Fleming's Observations on some species of Vermiculum. Mr Arnott read some extracts from Mr William Jameson's Journal of a Voyage round Cape Horn, and presented an Account of several new Musci, sent from South America, by Mr Jameson. Lastly, the Secretary read the concluding part of Dr Rusconi's paper on the Natural History of the Aquatic Salamander. 1823. May 3.

The Secretary read Professor Hansteen's Observations made on a Journey from Christiania to Bergen, across the high mountains. Dr Knox read a Memoir on the Organs of Sense and the Anatomy of the Poison-Gland, and Spur of the Ornithorynchus paradoxus of New Holland. Dr Hibbert read a notice regarding Pisiform Iron-Ore lately found at Papa Stour, in Shetland. And Mr Parry exhibited the Fossil Head of a very large Wild Boar, found imbedded in a peat-moss in Berkshire. May 17.

OFFICE-BEARERS, 1823.

Office-Bearers elected at the Meeting on the 1st December 1822.

President,

ROBERT JAMESON, Esq. Prof. Nat. Hist. Edin. &c.

Vice-Presidents,

ROBERT STEVENSON, Esq.	Rev. Dr DAVID RITCHIE,
DAVID FALCONAR, Esq.	Rev. Principal BAIRD.

Secretary, PATRICK NEILL, Esq.
Treasurer, WILLIAM ELLIS, Esq.
Librarian, JAMES WILSON, Esq.
Painter, P. SYME, Esq.

Council.

Dr SAMUEL HIBBERT.	R. K. GREVILLE, Esq.
PATRICK SMALL KEIR, Esq.	Sir WM. JARDINE, Bart.
ROBERT BALD, Esq.	Rev. J. GRIERSON, M. D.
Professor DUNBAR.	Professor GRAHAM.

List of Members of the Wernerian Natural History Society of Edinburgh,—continued from Vol. III.

RESIDENT.

1821.

May 19. John Sligo, Esq. of Seacliff.
Robert Edmond Grant, M. D. Edinburgh.
Robert Knox, M. D. Edinburgh.

Dec. 1. Adam Gibb Ellis, Esq. Edinburgh.
Anthony H. Gutsmere, Esq. Leith-Walk.
Dr Robert Graham, Professor of Botany, Edinburgh.
John Bogie, M. D. Edinburgh.
John Stark, Esq. Edinburgh.
Dr John Macintosh, Royal Artillery.

1822.

April 20. John Stewart, Esq. East Pilton.
John Anderson, Esq. younger of Gladswood.
Robert Scott, Esq. Edinburgh.
Robert Hamilton, M. D. Edinburgh.

Nov. 30. The Rev. Dr David Scott of Corstorphine.
George A. Walker Arnott, Esq.

1823.

April 19. Lieutenant Hugh Clapperton of the African Expedition.
Robert Johnston, Esq. Edinburgh.

1823.

April 19. James Young, Esq. Edinburgh.
Capt. Robert Andrew Waugh of Foxhall.
Francis Charles Parry, Esq. Edinburgh.

NON-RESIDENT.

1821.

May 19. The Rev. Thomas Wright of Borthwick.

Dec. 1. The Most Noble the Marquis of Hastings.
The Right Hon. the Earl of Dalhousie.
Lieut.-General Sir Thomas Brisbane, Bart.

1822.

April 20. John Richardson, M. D. Naturalist to the Arctic Overland Expedition.

Nov. 30. Hercules Scott, Esq. Professor of Moral Philosophy in the University and King's College, Aberdeen.
The Rev. Lansdown Guilding, B. A. F. L. S. &c. of St Vincent's.
Captain William Edward Parry, R. N.
Captain William Franklin, R. N.
Alexander Fisher, Esq. Surgeon, R. N.

1823.

April 19. John Davies, Esq. Manchester.

May 31. George Strickland, Esq.

FOREIGN.

1821.

Dec. 1. Dr William Arnold, Jamaica.

1822.

April 20. Dr H. F. Authenrieth of Tubingen.

H. Bowdich, Esq. Paris.

Nov. 30. Robert Lyal, M. D. Moscow.

1823.

April 19. Dr D. Frederick Schwægrichen, Professor of Natural History, Leipsig.

Prof. Frederick Hornschuch of Greifswaldt.

Mons. Charles Kunth of Paris.

Mons. Adolphe Brongniart of Paris.

Mons. Le Baron Delessert of Paris.

Mons. J. Gay of Paris.

Professor Silliman of New York.

Dr John Torrey of New York.

CORRESPONDING.

1822.

Nov. 30. The Rev. George Young, A. M. Whitby.

Laurence Edmondston, Esq. Zetland.

David Don, Esq. Librarian to the Linnean Society.

William Jack junior, Esq. Naturalist, Sumatra.

J. S. Miller, Esq. A. L. S. Bristol.

1823.

April 19. James Braid, Esq. Surgeon, Leadhills.

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